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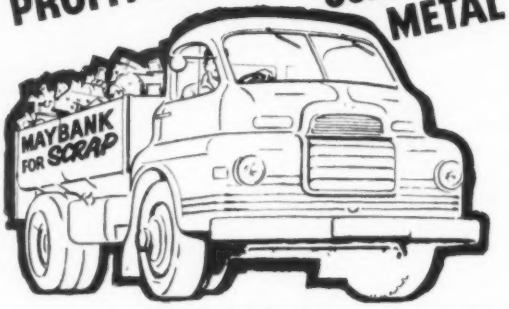

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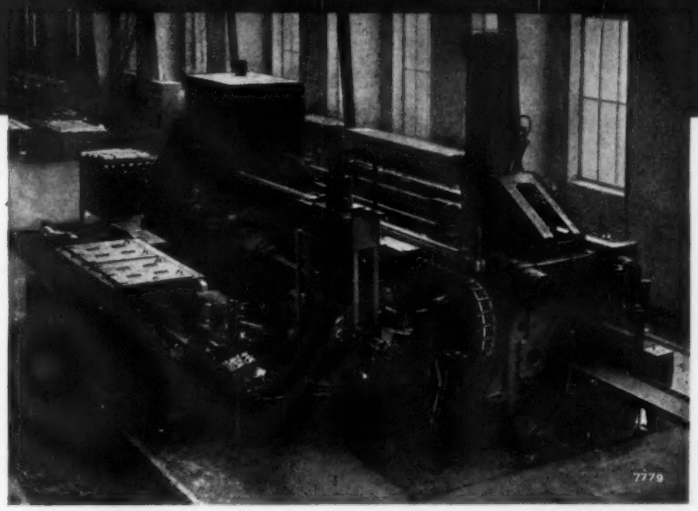

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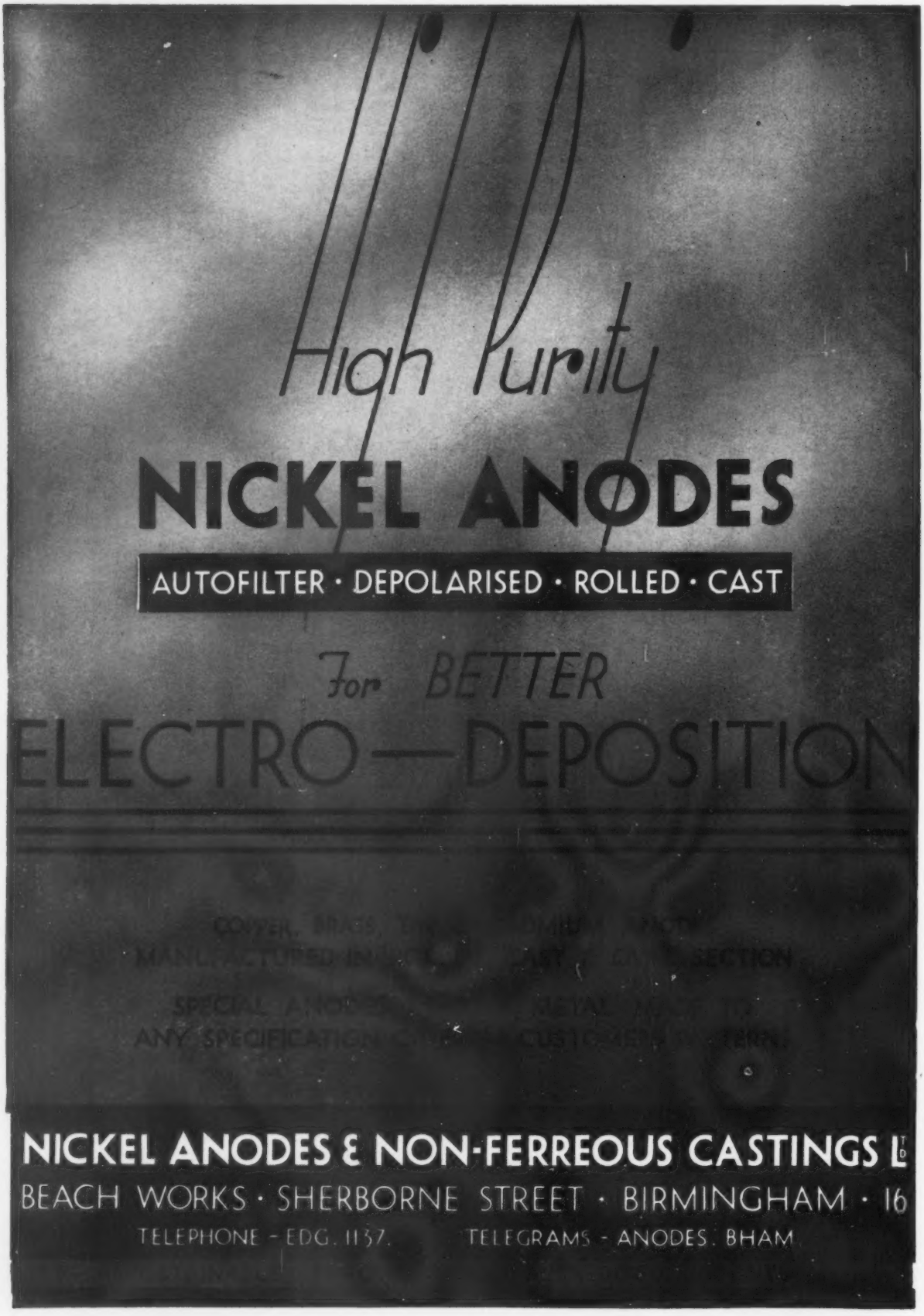
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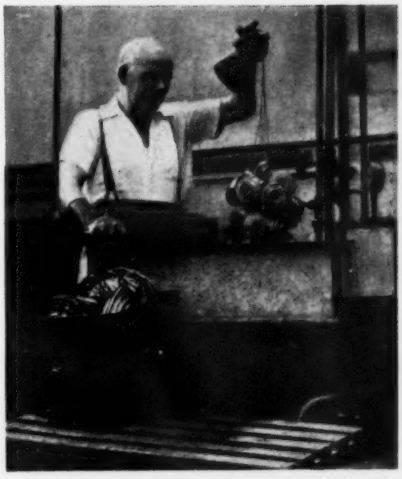

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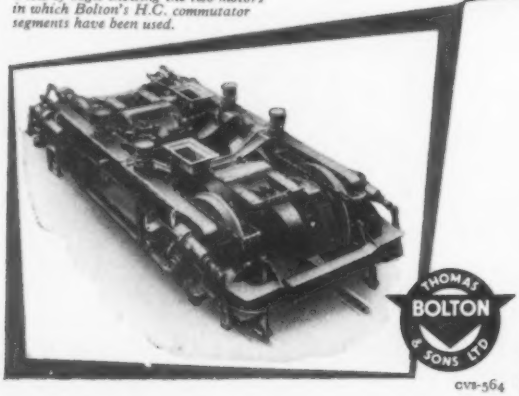

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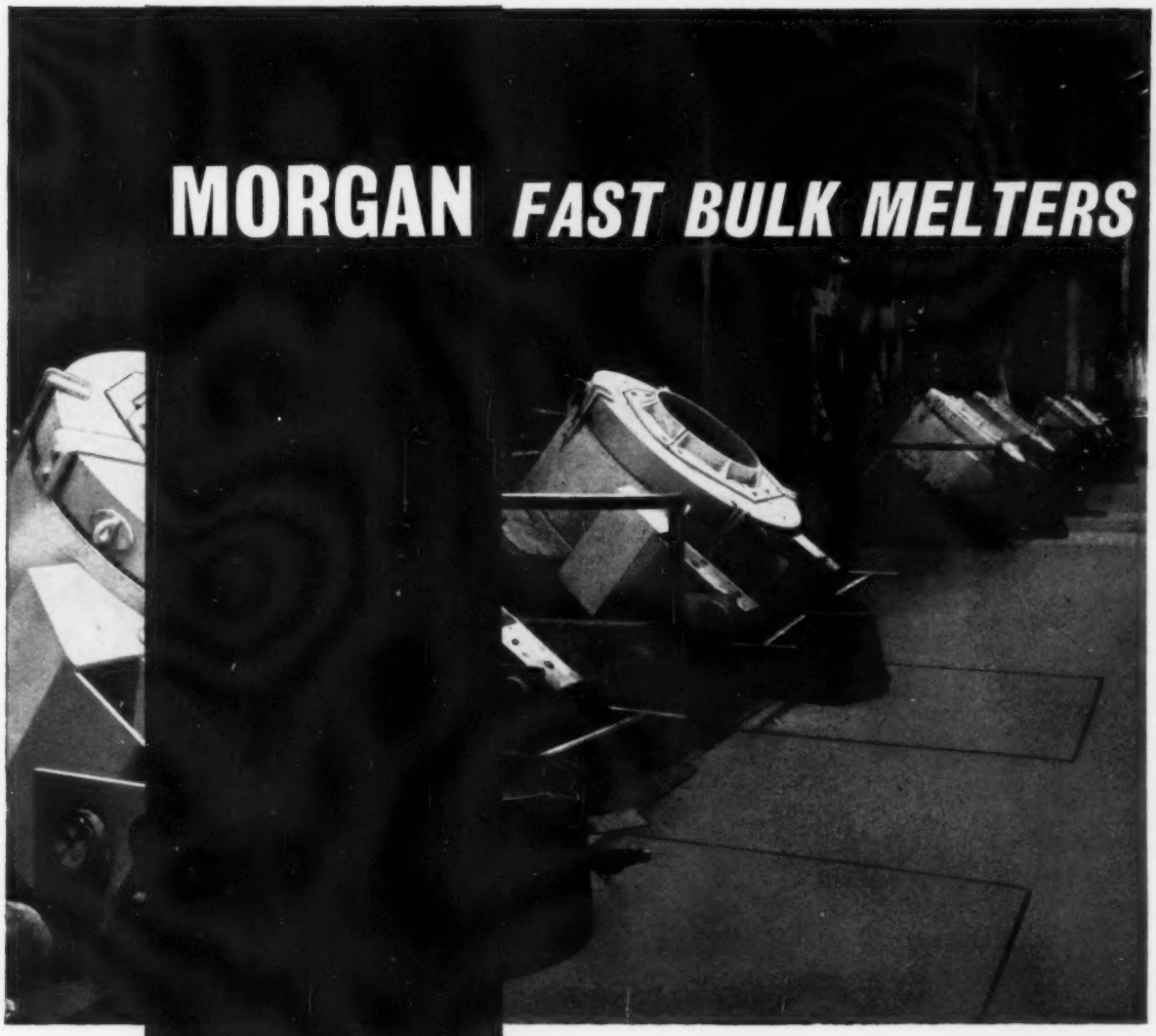

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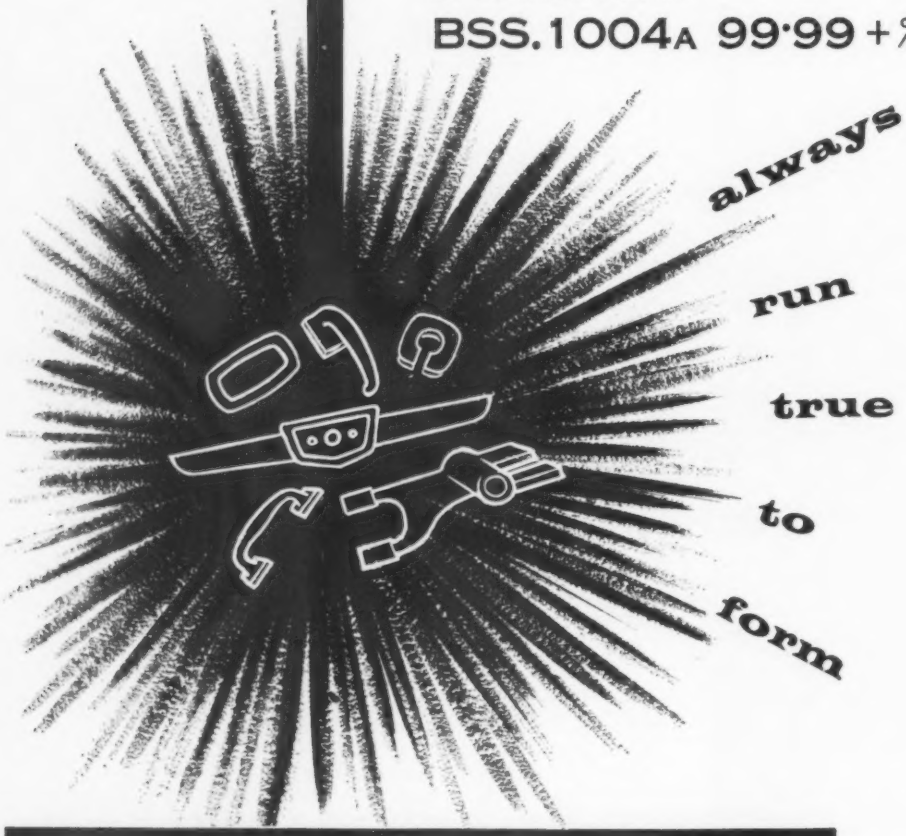

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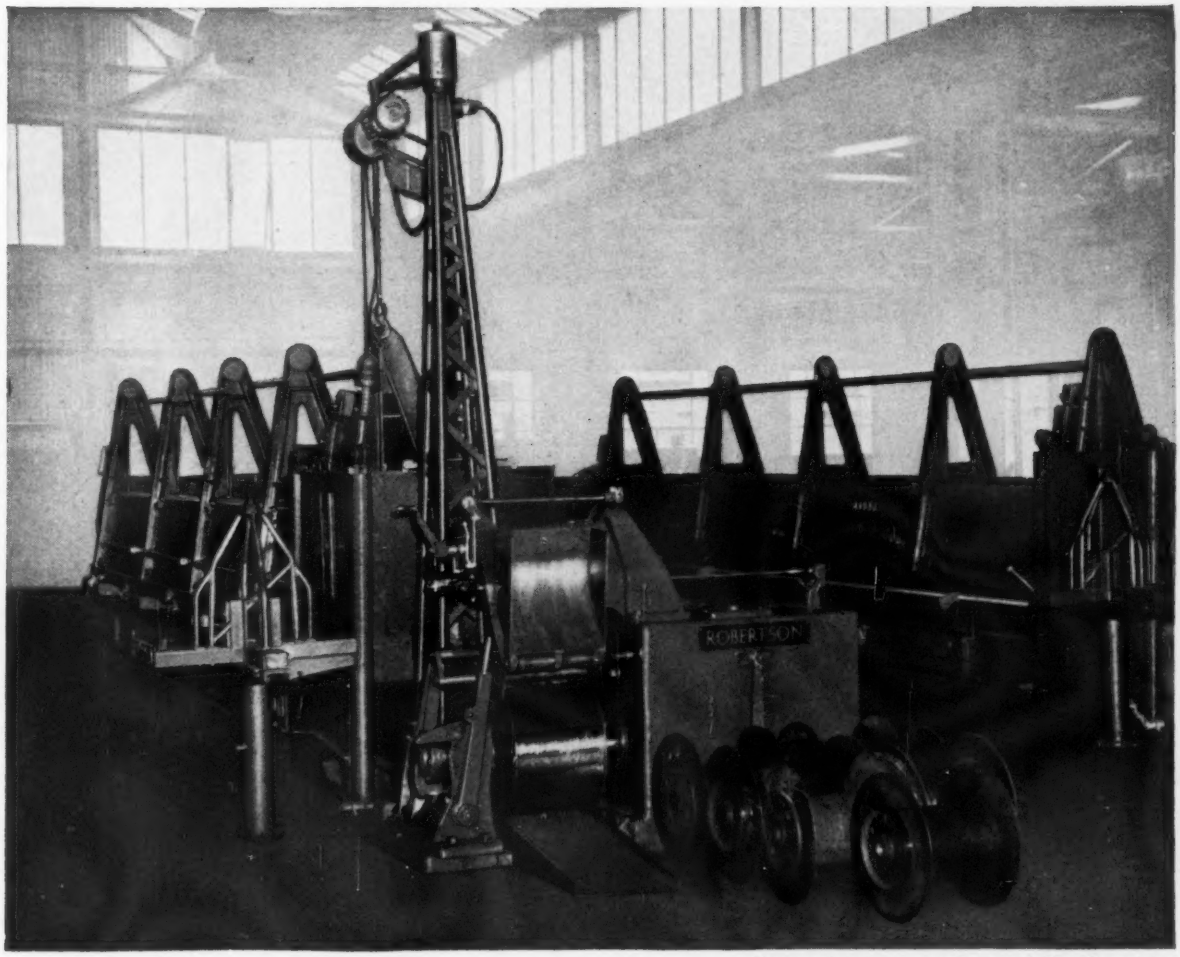

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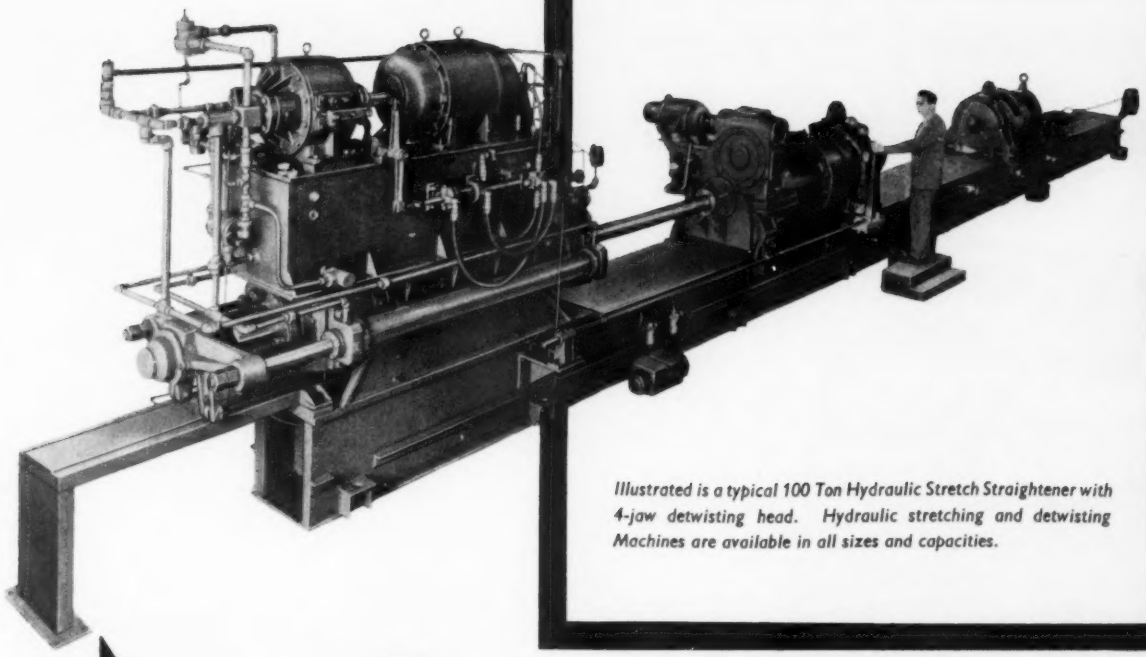

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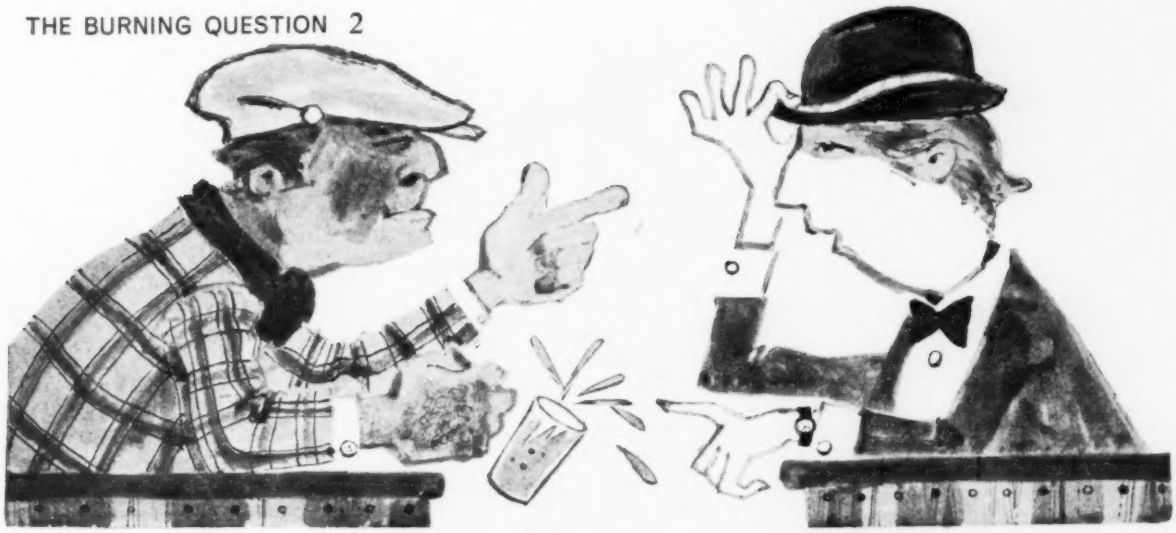

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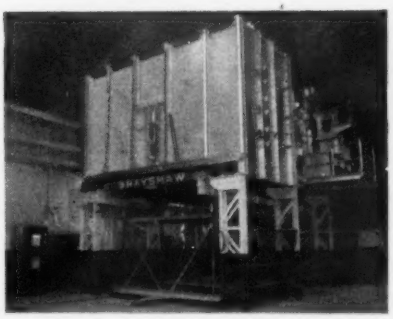

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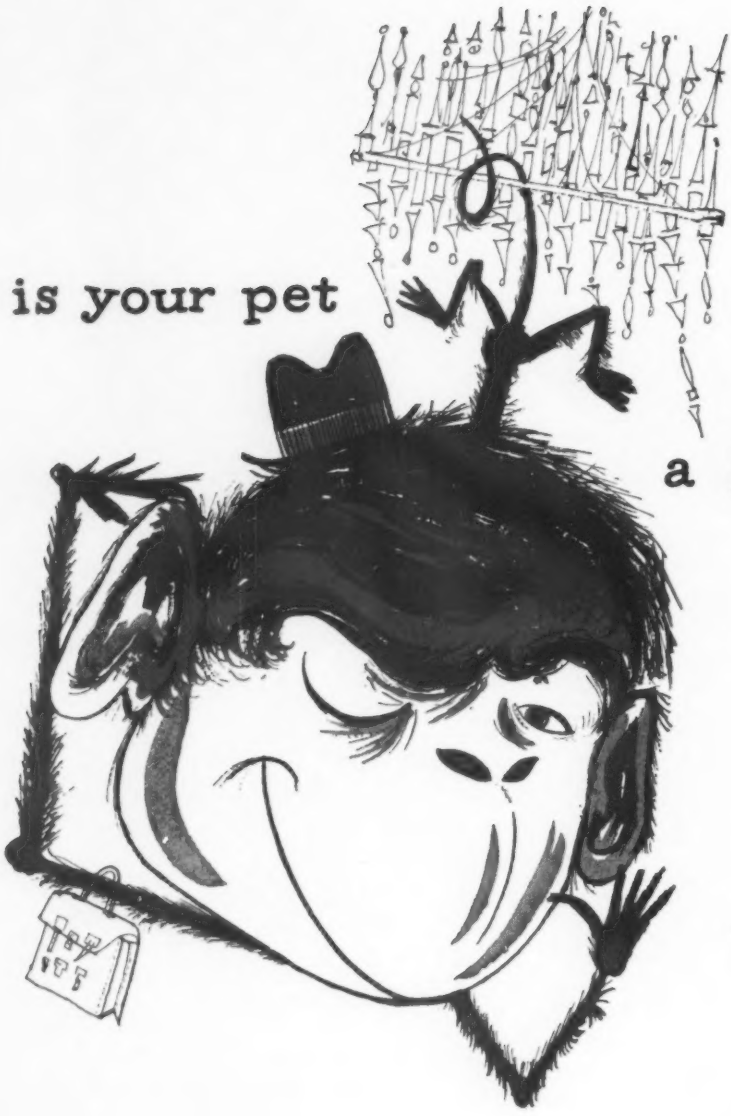

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METAL INDUSTRY

FOUNDED 1909

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MANAGING DIRECTOR
ARTHUR B. BOURNE, C.I.Mech.E.

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METAL INDUSTRY

24 NOVEMBER 1961

VOLUME 99

NUMBER 21

Aluminium World Agreement?

LAST week, in the United States, a call for a world agreement to increase the sale and consumption of aluminium was issued by four sections of the United States aluminium industry. At a press conference, Mr. Irving Lipkowitz, chairman of the Reynolds Metals Company, put forward this proposal on behalf of the Aluminum Association, the Aluminum Smelters Research Institute, the American Die Casting Institute, and the National Association of Aluminum Distributors. Mr. Lipkowitz said the agreement could be worked out with Government-industry co-operation to see that "equitable competition" applied throughout the industry, both in the United States and abroad, with the aim of increasing consumption to the point where the idle capacity of the industry in the U.S., Canada, and throughout the world could be fully utilized. He envisaged a series of industry-Government conferences to establish "an orderly pattern of marketing", and the agreement would cover the production of aluminium from its raw state to the finished product and would be based on historical patterns of production and consumption.

It appears, from his remarks, that the U.S. industry is particularly concerned over imports of aluminium sheet, foil, rod and bar which are "skimming the cream" from the American market. One thing that should be discussed with foreign producers, said Mr. Lipkowitz, was the matter of these imports. Another was the possibility of reducing tariffs imposed by foreign countries on U.S. aluminium and aluminium products which supplemented the output of aluminium abroad. The proposed agreement, he continued, would not limit imports of aluminium and aluminium products into the U.S. because foreign suppliers would participate in the growth of the industry brought about by higher consumption. *Per capita* consumption of aluminium in the U.S.A. was 23 lb., whereas in Europe and elsewhere it ranged from 8 to 15 lb.

Then again, he says, foreign markets offer a vast potential for increased consumption and United States companies already have invested abroad in various aluminium production facilities. In addition, there is a good market waiting for aluminium in irrigation supplies and electrification projects, but to develop these markets would take the resources of the entire industry and not merely those of the United States.

In conclusion, Mr. Lipkowitz said that the American industry had not discussed the matter of a world agreement with aluminium companies abroad, because of the fear of U.S. anti-trust action, and their reaction was not known. But, he added, an approach to a world agreement on a Government-to-Government level would relieve the domestic companies of doubts of anti-trust actions. It also appears that the U.S. industry has not held any formal discussions with the Government in Washington on such an agreement but it is suggested that, from informal discussions, no opposition has been expressed to the idea. So far, such informal discussions have been only with the United States Commerce Department.

In view of Great Britain's impending entry into the Common Market, and the increasing competition being faced by gravity die-casters, cost control assumes even greater importance than hitherto. In this article, which was one of the Papers presented at the recent Die Design Symposium organized by the Light Metal Founders Association, the author suggests some means of effecting economies and speeding production

Cost Control in Gravity Die-Casting

A GRAVITY die must provide within its design a means of achieving an economic price for a casting which has incorporated probably undercuts, changes in section, and the need for close tolerances and good surface finish. From these basic casting requirements, a die must be created to satisfy the following foundry principles, which reveal good design.

Time and Labour Factor—The die must produce castings at a competitive and economic production rate with the minimum use of semi-skilled labour.

Die Price and Die Life—The fulfilment of all requirements must be achieved within a die cost and die life which must be justified within the price structure of the casting.

Quality—The casting must have the requisite quality with regard to soundness, surface finish and accuracy.

Yield—Re-melt ratio in the form of runners and risers must be of amounts not so over-generous as to render uneconomic the casting price, or so sparing as to endanger soundness and production rates.

Fettling Costs—The cost of fettling the resultant casting must be kept to an absolute minimum, and such costs are invariably inherited from the die design.

Time and Labour Factor

The time taken and the number of casters and backers employed to produce each casting from a die usually forms the major portion of the labour and overhead content of the casting cost. In spite of this, however, many foundries have been slow to exploit aids available from specialist industries for speeding up the gravity process.

One section of the gravity die-casting industry where probably such criticism cannot be levelled, is associated with the production of pistons. In piston foundries there are to be found semi-automatic machines loaded with two impression dies where one operator controlling more than one machine can produce 360 castings/hr. Such designers have been quick to seize the aids available which are offered by other sections of industry, for instance, hydraulics, pneumatics, electronics. Help from specialists has resulted in wide use in the piston industry of hydraulically actuated dies with solenoid controlled hydraulic valves facilitating the electrical interlocking of the die movements, with electronic timers to control solidification dwell. It is disappointing to note that this approach is not usually applied to the production of other miscellaneous gravity die-castings even in instances where the potential is larger than for pistons.

Probably the simplest means of speeding up small die actuation is by power assisting the working by the application of pneumatics.

In Fig. 1 can be seen a small gravity die for producing a multi-bladed impeller casting. The air gaps between the fins are produced by twelve radially moved side cores in the die. Normally, in manual operation of such a die, each side core would be radially levered back and forth individually. In this particular case, by ingenious design of a slotted cam plate beneath the die, one stroke of the horizontally mounted air cylinder controlled from a hand valve, radially traverses the twelve cores simultaneously, and this arrangement is shown diagrammatically in Fig. 2. A small superstructure carries another air cylinder for raising and lowering a top locking ring, and the actuation is completed by a further small cylinder under the die to eject the casting. In this example, the simple air circuit provided has no provision for interlocking of the movements.

In more complicated dies, where out-of-sequence operation can cause damage to the casting or die parts, then interlocking of die part movements becomes necessary. With pneumatic operation, this is simply carried out by mounting a pilot valve to prove that

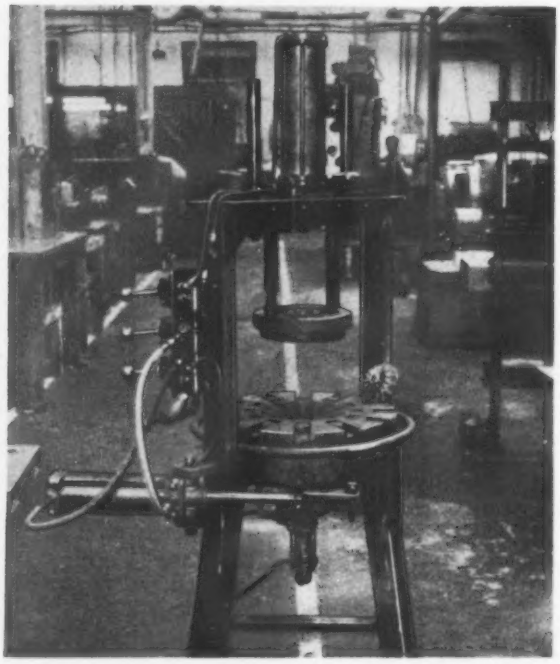


Fig. 1—Small gravity die arranged for pneumatic operation for producing a multi-bladed impeller casting

By

R. R. Woodward

(*High Duty Alloys Ltd.*)

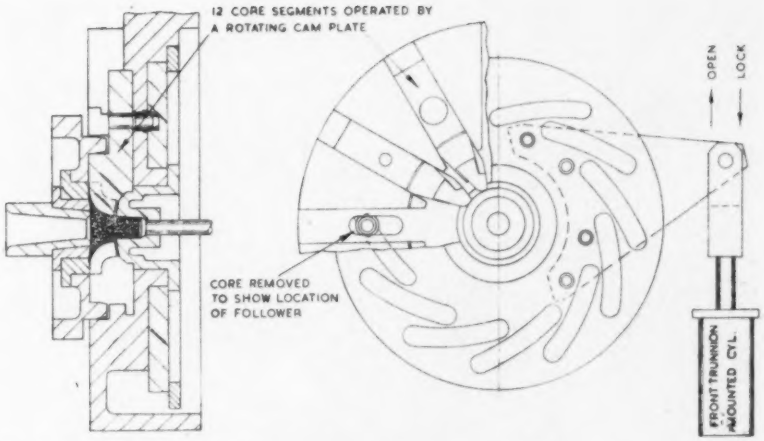

12 CORE SEGMENTS OPERATED BY A ROTATING CAM PLATE
CORE REMOVED TO SHOW LOCATION OF FOLLOWER
OPEN
LOCK
FRONT TRUNNION MOUNTED CYL.

Fig. 2. Arrangement of slotted cam plate for operating radially moved side cores

each die part movement has been successfully completed. The particular pilot valve depressed at the end of a movement then signals the main air circuit to make the next movement. The theoretical circuit for this method of pneumatic interlocking is shown diagrammatically in Fig. 3 and the corresponding typical die arrangement in Fig. 4.

An intermediate stage towards hydraulic power actuation is the use of hydro-pneumatic systems. In these systems, compressed air is the original source of power and this is then either by "dash pot" or "air-oil bottle" methods transposed either 1:1 or intensified into hydraulic pressure using oil or water as the final medium. The resultant hydraulic medium can be controlled speed- or volume-wise more efficiently for moving large die parts where otherwise a large diameter pneumatic cylinder would be employed and jerky movements thus encountered.

A very simple system of air-oil bottle hydro-pneumatic is in use on one large die in the gravity foundry of High Duty Alloys Limited (Slough). On this die, each side of the oil hydraulic actuation cylinder is pressurized from a small oil-air bottle reservoir stationed above it. Compressed air is admitted or

Fig. 3—Circuit diagram for pneumatic interlocking of die part movements

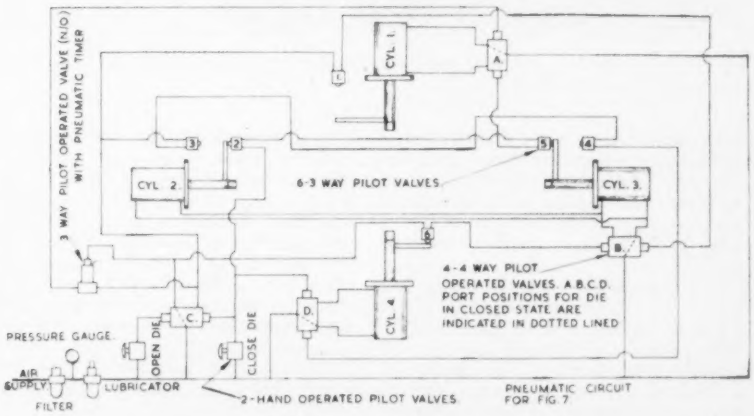


Fig. 4—Arrangement of typical die with pneumatic interlocking

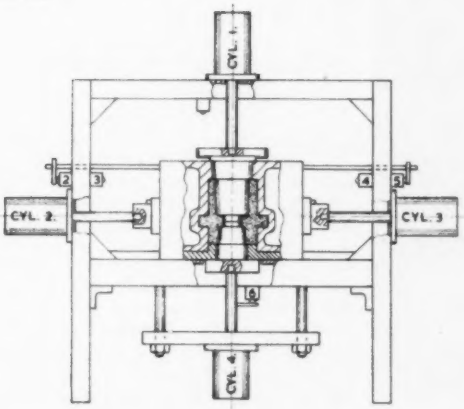
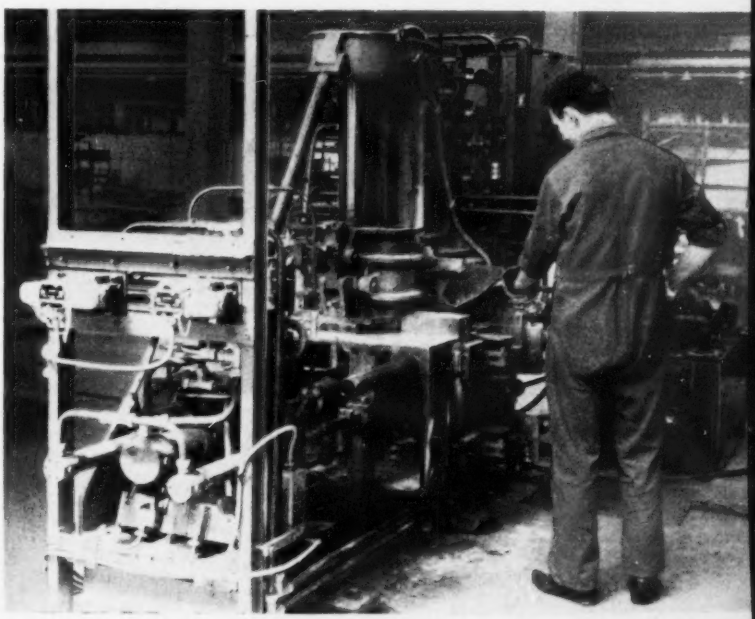


Fig. 5—Gravity die-casting machine coupled to a self-contained hydraulic power unit



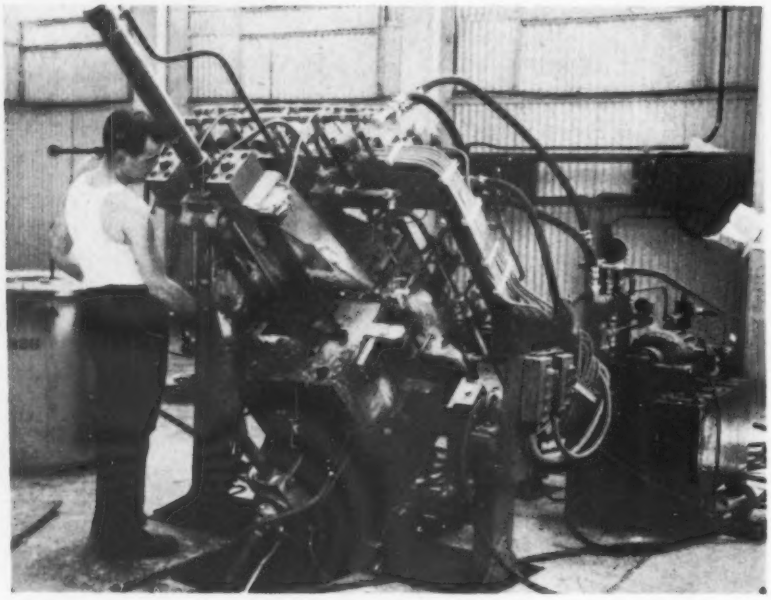


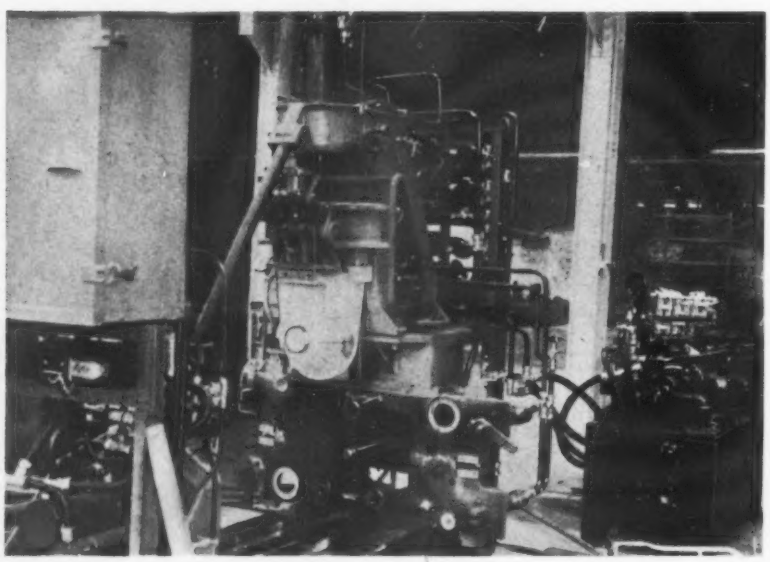
Fig. 6—Small gravity die-casting machine with hydraulic power unit and in-built tilting mechanism operating automatically

exhausted from the top of the bottles above the oil, as required, to pressurize the oil hydraulic cylinder. The cylinders and bottles used throughout were supplied by Maxam Power Limited from their standard range of equipment.

In applications where heavy die parts must be actuated, then the positive speed control and higher forces required demand the use of straight hydraulics for power assistance.

Probably the greatest steps forward in mechanization in the foundry industry have been made possible by the introduction of self-contained hydraulic power units which work on non-inflammable oils. These units can be stationed at the side of large hydraulic machine-actuated dies and will deliver non-inflammable oil at pressures up to 1,000 lb/in^2, and two are shown in use in Figs. 5 and 6. The machines in these two examples have electrically interlocked and hydraulically actuated opening and closing cycles controlled by push-button stations. Long cores are withdrawn by hydraulically operated toggle systems, which dispense with the necessity for die levers, whilst the die locking clamps are unlocked or applied by small hydraulic cylinders controlled electrically within the automatic opening or closing cycle. This latter innovation dispenses with the inconvenience of walking around the die to apply hand clamps. Fig. 7 shows the machine of Fig. 5 with main die parts removed.

Fig. 7—Gravity die-casting machine depicted in Fig. 5 with the main die parts removed and main core assembly in raised position



These machine-operated dies represent the last word in competition against the pressure die-casting foundry approach in that the operator has only to pour the casting and, after depressing a button or foot switch, wait for the casting to be ejected virtually on to his tongs after a pre-arranged solidification dwell controlled by electric timers.

The largest of the machines has been designed for use in conjunction with an automatic ladle and, in the case of the small machine, the tilting operation is in-built as an automatic phase.

An obvious extension to these schemes would be automatic removal of the castings mechanically.

Die Price and Die Life

The first step when designing a die is to ensure that the casting can be produced by the die facilities to be made available. These facilities, governed by the price structure of the casting, depend mainly upon the number of castings involved. A simple hand die costing £300 may be all that is justified by a demand for 5,000 castings per annum for two years, and many desirable features which could be incorporated in the die design for reducing cost of casting production may have to be omitted because the outlay would never be recovered fully. On the other hand, if the demand is 500,000 castings per annum for three years, then these features could, perhaps, be incorporated in a fully mechanized die costing, say, £3,000.

These problems are normally solved at the estimating stage, but they are too complex for discussion here. However, the designer is usually presented with a guide consisting of casting and die price, which form the limiting factors in extent of die design and mechanization.

(To be concluded)

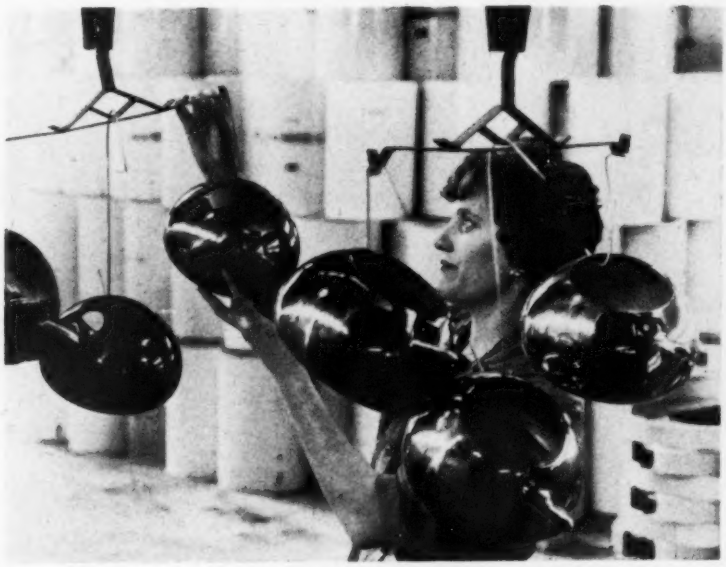
Obituary

Mr. R. D. MacMillan

WE regret to record the death of Mr. Robert Davidson MacMillan, managing director of Controlled Heat and Air Ltd. (a member of the Incandescent group of companies). He was educated at Glasgow Technical College, served his apprenticeship with A. and J. Inglis Limited, and in 1927 joined the Pneumatic Conveyance and Extraction Company of Manchester, and later the Carrier-Owen Engineering Company Ltd., London. He joined Controlled Heat and Air Limited in 1933 as chief designer, and was appointed managing director in 1945.

High Reflectivity Colour Finishes

By D. N. Carr
(*Carrs Paints Ltd.*)



[Courtesy Thermair Domestic Appliances Ltd.

IMPROVED LACQUER COATINGS FOR NON-FERROUS METAL PRODUCTS

FOR decorative purposes, the reflectivity of certain non-ferrous metals has long been utilized. "B.M.A." and Florentine Bronze have proved strong favourites for many forms of household furnishings for many years and with the expanding use of aluminium, coupled with the fashion for bright colours, great use is being made of coloured anodic coatings.

All these finishes are expensive to produce, and only with the dyed anodic film is any degree of durability produced. Bronze is expensive for mass produced household hardware and the "aged" effect produced by heating is usually inconsistent on batch production. The oxide coating is readily destroyed and can only be protected by thin coats of air-drying lacquers as stoving promotes further colour change. Thus, true B.M.A. is an expensive process with little durability.

A later development towards the production of a cheaper process has been to plate a zinc alloy with a layer of bronze and to discolour it with chemical powders to produce a B.M.A. and Florentine Bronze effect. Unfortunately, this process tends to entrap the chemical solutions in the pores of the castings. These solutions expand when heated, producing blisters, thus prohibiting the use of a stoving lacquer which would give optimum durability. The finish is also costly to produce.

Coloured anodic films produced upon aluminium are usually extremely durable and do not require further protection. It is always extremely difficult, however, to produce consistent anodic films to absorb a standard amount of dye; thus colour matching requires a great deal of skill. Special grades of aluminium suitable for anodizing are required, costing substantially more than standard alloys, and these are not always ideally suited to certain fabricating processes. The plant required is elaborate and requires skilled attention. When colouring aluminium holloware with anodic processes it is usually impracticable to mask the interior of the vessels. Consumers, generally, dislike coloured surfaces to contact their foodstuffs and there have been unfortunate cases in the past where incompletely sealed anodic films have allowed the dies to "run", discolouring the contents of the vessels. It is also impossible to produce a matching effect when the article is required to match components manufactured from other metals.

It is now, however, possible to produce very similar but durable colorations to those discussed purely upon zinc alloys and standard grades of aluminium. These colours can be made to resemble B.M.A., Florentine Bronze, brass, copper and also all the bright shades usually associated with anodizing. In every case, the eventual durability is of a very high order and the nature of the process enables the interior surfaces of holloware vessels to be easily masked.

These finishes utilize synthetic resin coatings, and films may be produced that adhere strongly to bright reflective surfaces. The films may be so coloured to produce matching effects for any shade.

Lacquer Properties

The requisite properties of such materials are that they must allow maximum light transmission, have hard abrasion resistant surfaces, high resistance to heat, humidity, water, detergent solutions, etc. Owing to the fact that the ultimate finish will be highly reflective, the resins must "heat cure" easily as large amounts of transmitted heat will be reflected away during the stoving process.

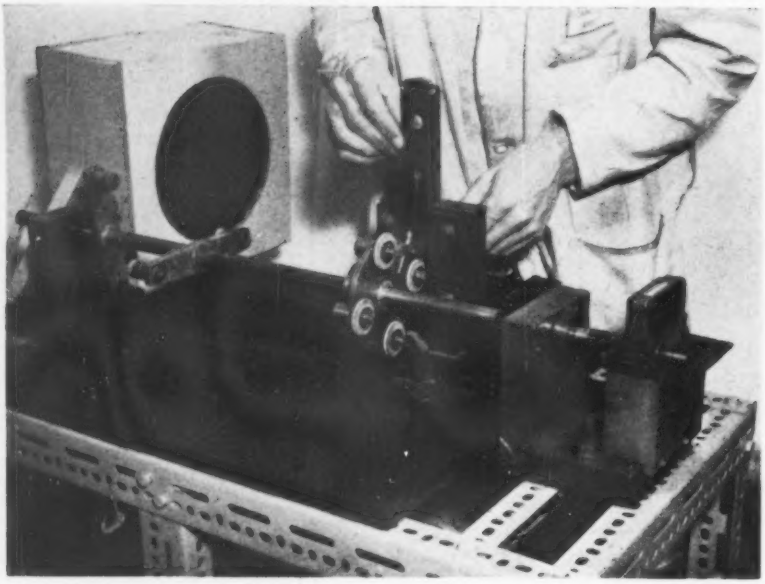
It is now possible to formulate organic coatings with all these properties, and many manufacturers are taking advantage of these features, gaining both in cost and quality.

The above specification will provide a material suitable for domestic holloware such as electric kettles, coffee percolators, "stew pan" lids, or teapots, domestic appliance components such as washing machine lids, controls, etc., and general hardware in the category of door handles, letter boxes, component sets, etc. They have also been suggested for use as attractive colourings for internal car trim.

Method of Application

Application is relatively simple, and as the coloured lacquer layer normally filters light reflected from the metal surface, the ultimate brightness depends upon surface preparation. For maximum reflectivity, surfaces must be polished, although attractive satin finishes may be attained by linishing, and "whiter", more opaque results can be achieved upon chemically etched surfaces. All three preparations produce finishes different in appearance and it is not possible to match colours upon different surfaces.

All articles to be coated must be thoroughly degreased prior to application paying particular attention to polished products where grease is liable to have become forced into and sealed in the metal during polishing. Cold degreasing solutions do not always remove this contamination, owing to its inaccessibility, and it is only when the grease expands in the stoving process



[Courtesy Yale and Towne Manufacturing Co. Ltd.

Furniture plate being placed in abrasion test rig. The copper brush detects removal of the surface coating relaying an audible signal to the loud speaker seen to the left

that it appears, producing defects in the lacquer film. Optimum results are, therefore, obtained by using hot degreasants, which tend to expand and thus to remove all grease pockets.

To produce a uniform colour, the lacquer film must be applied evenly to avoid "shading", as the ultimate depth of colour depends upon film thickness. This precludes the use of dipping, as it is impossible to produce a finish of requisite evenness.

Normally, the coatings are applied to the prepared surfaces by spray at a pressure of between 70-80 lb/in^2, which provides maximum atomization and evenness of coat. A colour standard is kept near at hand and all articles are sprayed to obtain the correct depth of colour.

No difficulty is usually experienced in production conditions in producing completely consistent results. After a brief "flash-off" time articles are heat-cured.

Convection ovens normally produce more easily controlled results as they do not wholly depend upon the absorption of radiated heat as do infra-red tunnels. The high reflectivity of the finish tends to reflect large quantities of heat to waste.

Furniture plates being coated with B.M.A. shade finish at Yale & Towne Mfg. Co. Ltd.

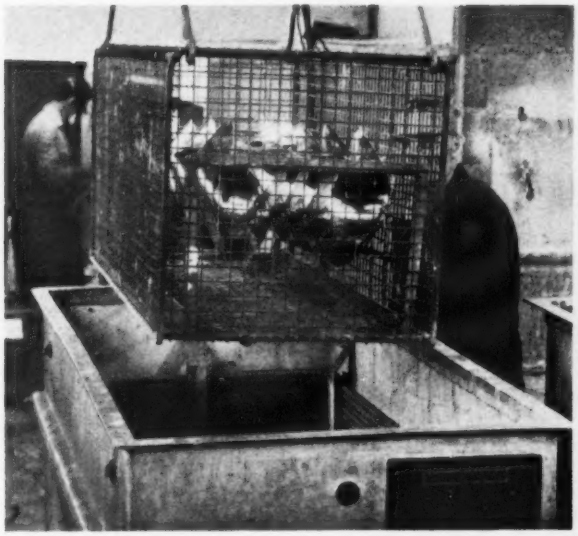
Practical Examples

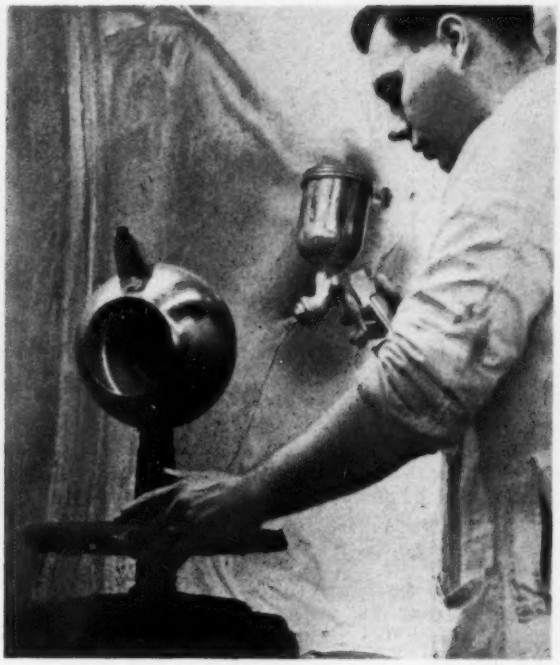
To illustrate the superiority of lacquered coatings it is interesting to study the methods used by The Yale and Towne Manufacturing Co., a company which mass produces door furnishing on a very large scale. A large proportion of their original production models were produced in powdered B.M.A., but considerable difficulties were encountered in attaining consistent colour standards during the process. The porosity and sensitivity of the oxide film precluded the use of a stoving lacquer and air-dried coatings were not durable enough for their customary standard of work. The problem was then approached with the use of a special lacquer coating upon zinc alloy die-castings.

Several methods of surface preparation were tested including polishing, linishing, and "sateening". Eventually, "sateening" was considered to produce the most attractive effect and also an ideal surface for the coating to adhere to. Great importance has always been attached by Yale and Towne Manufacturing Co. to the ultimate longevity of their products and to ensure that the surface finish should resist several years' handling. In order to obtain a standard degree of measurement they designed and constructed a special abrasion testing machine. This consists of a rotating disc to which abrasive circular rubbers have been attached at the perimeter, each free to rotate in its own axis. The test piece is moved a measured amount into the radius of the rubbers, which are rotated at a standard speed. The number of abrasions to remove the smallest amount of the coating are then measured electrically. To combat the effects of humid conditions encountered in kitchens, etc., a boiling water test was also devised to ascertain rapidly the humidity resistance of the coating. In this test a coated fitting is immersed in boiling water and examined every minute by rubbing with a special prepared pad at a set pressure. The time taken to remove the lacquer film is then noted. Many lacquer formulations were tried and eventually one was selected utilizing an epoxy base that provided ease of application coupled with optimum durability factors.

On The Yale and Towne Manufacturing Co.'s abrasion testing machine it was found that whereas the standard finish failed after 100 unit abrasions, the new lacquer coating withstood 12,000. In their boiling water test, the standard was failing after a period of 30 sec. and the new finish withstood 30 min. without demonstrating loss of adhesion.

The new lacquer coatings have now been in use for a considerable period, resulting in a consistent appearance, first class durability and greatly simplified production processes.





Above: Kettle bodies jigged for degreasing in hot trichloroethylene vapour prior to coating with lacquer [Courtesy Thermair Domestic Appliances Ltd.

Right: Kettle bodies being spray coated with bright anodizing effect finish at Thermair Domestic Appliances Ltd.

The components are mounted on jigs and sprayed by female operators before transfer to a "camel back" Ballard oven for stoving at 390° F. for 15 min. After a brief cooling period they attain maximum hardness and are then sent off for assembling. This has enabled "traditional" finish to be mass produced.

These materials are also showing great promise in relation to the domestic holloware trade, and extensive work is being conducted upon electric kettles, coffee percolators and "stew pan" lids. "Field" tests have been conducted for over six years and not one case of breakdown has been reported.

The lacquer coating is produced with a relatively high heat resistance which will withstand the heat of boiling water indefinitely and is also unaffected by the appliance boiling dry. This has been used to great advantage by Thermair Domestic Appliances Ltd., who have already produced large quantities of kettles and percolators applied with brightly coloured films to resemble anodic coatings.

The new process has eliminated colour matching problems, enabling a more economical type of aluminium to be used, and it produces a much more durable and competitive finish.

All articles are polished and hot degreased in trichloroethylene vapour before spraying with a uniform lacquer coating and curing in an infra-red oven.

The abrasion resistance and the general properties have been found comparable with those of anodizing.

For inexpensive articles where polishing or linishing is not justifiable, a silver primer may be incorporated, which hides all metal defects. This may then be recoated in the same way as described. The resultant finish, however, does not possess the same brilliance as other preparations but can be regarded as an inexpensive attractive substitute.

Lead-Coated Steel

IN order to evaluate alternative methods for producing lead-coated steel can-stock for possible utilization in containers not intended for food, a study of coating methods was made at the University of British Columbia.

Among the studies carried out was one to determine the practicability of coating a steel substrate with a thin layer of lead by directly roll-compacting lead powder upon prepared steel strip and to establish economical and satisfactory procedures by experiment.

Steel container stock (0·07 carbon, 0·017 in. thick) was coated with lead by the roll-compaction of lead shot and atomized powders. Among the variables studied were: Steel strip condition—surface abraded, sand-blasted, chemically-pickled, oxidized and reduced. Lead particle size — seven sizes ranging from $-10+40$ mesh to -325 mesh. Rolling variables—speeds 3, 35, and 140 ft/min., roll gap 0 to 0·030 in., rolling force 5,000 to 15,000 lb.

Horizontal feeding into rolls of a steel strip manually coated with powder by shaking through a screen was adopted. Different applied coating thicknesses have been used.

Coatings have been evaluated by means of bend tests (180° over single strip radius), tensile tests, cupping tests, salt-water corrosion tests, thermal stripping tests, uniformity of coating tests, and also metallographic examination.

Excellent adherence of pure lead to steel strip was obtained using pickled or oxidized-reduced steel surfaces, lead of any screen fraction within the range above, and rolling speeds of 3 and 35 ft/min. Roll gap and force were governed by thickness of applied particulate coating, and the size of the lead particles employed.

Coatings which passed all mechanical tests without failure ranged from 0·001 in. to 0·015 in. in thickness. Thicker coatings are certainly possible, but <0·001 in. layers have not been obtained with good quality as yet.

The coating process does not result in more than about 5 per cent reduction in the thickness of the steel strip, and usually much less. Thus, the formability of the steel is not seriously affected by this method of lead application. Typically, a rolling load of 8,000 lb. was involved in obtaining a 0·002 in. coating from -100 mesh atomized powder.

Uniformity of coating thickness to within ±5 per cent of nominal appears to be readily obtainable in the range of thicknesses studied.

To date, coatings of <0·005 in. thickness have been found to possess a high density of pinholes. However, there are indications that this problem may be overcome with further work.

OUT OF THE MELTING POT

In Accord

ANY explanation of the mechanism of the levelling or smoothing effect of certain additives to plating baths must take into account the experimentally established fact that all such additives raise the cathode polarization, and the observation that the additives or their decomposition products become incorporated into the deposit. The most likely theory of the levelling mechanism regards it as being connected with the formation of a concentration gradient as a result of the inclusion of the additive into the deposit and the consequent depletion of the solution in the immediate vicinity of the cathode surface. This concentration gradient, in turn, results in the rates of supply of the molecules (or ions) to peaks and depressions on the surface being different, the difference in the concentration of the additive at the peaks and in the depressions causing a redistribution of current and consequently a levelling or smoothing of the surface of the deposit. If this theory is correct, the levelling effect would diminish or would disappear altogether if the plating were carried out under conditions tending to counteract the formation of the concentration gradient referred to above. Such conditions are provided, for example, when a periodically interrupted plating current is used, the gradient being reduced during the "off" period to a degree depending on the frequency of the interruption and on the ratio of the "off" to "on" periods. These deductions from theory have been confirmed in practice using a Watts type nickel plating bath saturated with coumarin as the levelling additive. The nickel was deposited to a thickness of about 5μ on a polished copper cathode, the levelling action being evaluated from the change in depth of 10μ-deep scratches made in the cathode surface by the diamond point of a microhardness testing machine. It was observed, that for a constant "off":"on" ratio, the levelling action started to drop rapidly after the frequency of interruption had reached a certain value (about 1 cycle/sec.). Also, it was found that, keeping the frequency constant at about this value, the levelling effect diminished rapidly with increasing value of the "off":"on" ratio, decreasing, at a ratio of 10, to a value observed in a solution containing no levelling additive.

Devaluation

DISCUSSION of the difficulties presented by the growing amount of reading-matter tend to concentrate on the purely quantitative aspects of the problem. This emphasis very naturally results in most of the solutions that are proposed towards alleviating the problem being likewise of a quantitative nature. Certainly the most popular procedure is the reduction of the volume of the reading-matter by abridgement, condensation, abstracting or listing. Adoption of this procedure entails a progressive diminution in quality, from summaries that one can read to lists of titles and references that are only meant for scanning. It also, of course, entails a progressive reduction in the amount of information that is conveyed. This reduction can be tolerated so long as an indication of an identifiable source of the information is retained from which additional information can be obtained, given the need, the time and the ability to secure the source. Unfortunately, condensation of information is not always halted at this essential minimum. Instead of being regarded and treated as information, even if condensed to the minimum, the subject matter is instead treated and presented as news. This news may then, in turn, be reduced in size to such uninformative news items as: "Navy is seeking infra-red masers to operate through 2 windows found by Soviets in the long-wavelength regions of the infra-red. The main obstacle is to find the right materials". If this trend continues—and there are increasing indications that it will—then to complaints about lack of time for reading will be added complaints about the waste of time on reading.

Pleasant Meeting

IN these days when most newly invented alloys are either heat-resistant, exotic or radioactive, with the balance being titanium alloys comprising a Greek letter and some alloying constituents with no immediately obvious functions, it is a relief to chance upon an aluminium alloy which aspires to no higher calling than that of being especially suitable for use in the production of cast products for bearing application. Like so many other aluminium alloys having improved bearing properties, the new alloy contains tin (0·2 to 3 per cent). In the past, the addition of tin inevitably resulted in the formation of an interdendritic film which made the alloy prone to hot shortness. This tendency to hot shortness made it difficult to produce economically not only pressure die-castings, but also sand and gravity die-castings. It has now been discovered that this effect of tin additions in forming an interdendritic film can be suppressed by the addition of cadmium and lead to the alloy. The alloy accordingly contains 2-6 per cent copper and 0·1-12 per cent silicon as hardening elements, and 0·2-3 per cent tin, 0·2-2 per cent lead, and 0·2-5 per cent cadmium. Alloys containing 2 to 12 per cent silicon are particularly suitable for pressure die-casting. The total tin, lead and cadmium content should preferably not exceed 1·5 per cent and, if hot shortness is to be avoided, the tin content should not exceed the combined contents of lead and cadmium. An example of an alloy falling within the above range is provided by a composition comprising 5 per cent silicon, 4 per cent copper and 0·7 per cent each of tin, lead and cadmium. This alloy can be pressure die-cast at 650-680°C. By using it to cast connecting rods, electric motor end bells, housings for hand power tools, etc., the necessity for separate bearings in each instance can be eliminated.

Skimmer

Metals in Industry

SOME ITEMS OF NON-FERROUS INTEREST SHOWN AT THE ENGINEERING MATERIALS AND DESIGN EXHIBITION

TOO many wares, too many people, and too much literature are common to most exhibitions. Fortunately, the second Engineering Materials and Design Exhibition, which closed a week ago at Earls Court, has not yet become too extensive. Though it contained little essentially new, it yet provided an opportunity to see a variety of interesting developments in materials and processes.

Perhaps the newest work on exhibition was that on the stand of U.K.A.E.A., where, *inter alia*, developments in roll-welded aluminium-clad cadmium plate were shown. Cladding is carried out by a roll welding process developed at Birmingham University. The cadmium plate, $\frac{1}{16}$ in × 6 in × 36 in., is enveloped in aluminium, heated to 300°C. and rolled to 60 per cent reduction. Ultrasonic testing is used to detect any bonding defects and to plot the unbonded areas and indicate the interface involved.

Also on this stand was a description of work on high temperature thermocouple and sheath materials for use in conjunction with graphite or helium. Tests have shown that indium and rhenium may prove useful as sheath materials and promising thermocouple junctions include W/WRe_{26}; W/Re; W/Ir; and W/$IrRh_{10}$.

A demonstration of spark machining of narrow slots, using a copper wire electrode with a "cheese-cutting" action, also drew considerable attention on the U.K.A.E.A. stand.

Samples of powder metal parts in niobium and vanadium were also shown, with a model of an hydrostatic press giving pressures up to 20,000 lb/in^2.

Powder Metal Products

Six firms were also exhibiting products of powder metallurgical origin, ranging from bearing bushes of all sizes, small high precision pinions and gears, toy, lock and clock parts, to large filter plates and friction plates for brake and clutch components. One of the characteristics of powder metal parts is that they can be produced in a wide range of ferrous and non-ferrous materials — and several metals can be fabricated only in this way. Exhibitors of powder metal parts were Bound Brook Bearings Ltd., Johnson, Matthey and Company Ltd., Manganese Bronze and Brass Co. Ltd., John Rigby and Sons Ltd., Sintered Metal Components (Chard) Ltd. and Sintered Products, Limited.

Jointing Techniques

Several stands featured the joining of metals by one process or another, and among these a live demonstration of the production possibilities of low temperature silver brazing, using a Radyne induction heater, on the stand of Johnson, Matthey and Co. Ltd., created considerable interest.

Dewrance and Co. Ltd. were showing the properties and advantages of high temperature brazing for stainless steel, high-nickel alloys, and the cobalt-base alloys—most of which present difficulty in joining by other processes.

Welding electrodes for resistance welding were shown by Langley Alloys Ltd., and brazing alloys were shown by Engelhard Industries Ltd. and Imperial Chemical Industries Ltd., as well as those already mentioned.

Special rivets and fastenings were shown by Avdel Ltd., including "Huckbolts" and "Chobert" rivets, and the equipment for use with them.

Castings

Castings of all kinds were exhibited on a great many stands, and it is not possible to mention them all here. Among those which drew attention, however, were those in "Dairy Metal", a 20 per cent nickel bronze with a low zinc content. This alloy, which has a white reflective finish when polished, is of particular value for castings for food processing machinery and surgical equipment. Being free machining, it can often be used more economically than stainless steel where corrosion resistance is of prime importance. Produced by Brecknell, Dolman and Rogers Ltd., these castings in this material were on the stand of the O'Neill Organization.

Emphasis was laid on the choice of design, material and process on the stand of the Association of Bronze and Brass Founders. Examples of very many castings were shown, including a ship's propeller, a gravity die-cast aluminium bronze window-mounting for a sports car and some types of continuous cast rod.

Centrifugal castings were featured on a number of stands, including the one just mentioned, where Spunalloys Ltd. showed a large, flanged bronze bush cast by this technique. Firth-Vickers Stainless Steels Ltd. showed stainless steel centrifugally cast products, Metals and Alloys Ltd. showed a number of centrifugal castings with bosses and shaped parts as well as surfaces of rotation, and Sheepbridge Alloy Castings Ltd. also produce non-ferrous castings by this means, including bimetallic cylinders and rolls.

On the stand of the Magnesium Industry Council were examples of forgings in magnesium for "Viscount" aircraft landing gear, a variety of sand castings and a number of the pressure die-castings used in the "Dictaphone". Examples were also shown of magnesium fuel cans for atomic reactors. However, working exhibits invariably draw the most onlookers, and the high speed turning of magnesium alloy spools on this stand was no exception.

Together with a range of castings in a wide variety of alloys, Dewrance and Co. showed the stages in the production of a casting — design, pattern-making, moulding, casting.

Pressure die-castings were not featured as widely as might have been expected, the only stands devoted entirely to them being those of J. V. Murcott and Sons Ltd., who showed some of the new castings for the Perkins 40 h.p. outboard motor, and that of the Zinc Alloy Die-Casters Association, which showed a wide range of castings in zinc alloys to B.S.1004 and in light alloys. Other stands showing pressure die-castings included Carlton Castings (a member of the O'Neill Organization).

Other Products

Some of the applications of metallic meshes, and the wide variety of materials and meshes available, including copper, brass and anodized aluminium, were exhibited by the Expanded Metal Co. Ltd.

Among the many firms exhibiting materials in semi-fabricated forms were Imperial Chemical Industries Ltd., with especial emphasis on titanium and zirconium, nuclear fuel cans and heat transfer sheet. The special properties and applications of nickel and its alloys were featured by The International Nickel Co. (Mond) Ltd. Nickel alloys were also shown on a number of other stands, some of which have already been mentioned; others include Langley Alloys Ltd., Lloyds (Burton) Ltd., Samuel Osborn and Co. Ltd., and Henry Wiggin and Company Ltd. Precious metals were

shown on the stand of Engelhard Industries Ltd. and also that of Johnson, Matthey and Co. Ltd., who featured platinum in the glass industry.

Special electrical materials were shown on the stand of Telcon Metals Ltd., as also were thermostatic bimetals. Magnetic alloys, strip and castings in beryllium-copper were also exhibited.

In the field of metal finishing, undoubtedly the stand that attracted the premier interest was that of Precious Metal Depositors Ltd., where a demonstration of gold plating was in progress. Examples were also shown of molybdenum strip and washers plated with silver and gold, as well as a variety of plated electrical and electronic parts.

Several other stands had examples of metal finishes, including Coated Strip Ltd., Coating Contractors Ltd., Engelhard Industries Ltd., John Harper and Co. Ltd., and the U.K.A.E.A.

MEN and Metals

After 33 years' service with Imperial Chemical Industries Limited, **Dr. John Ferguson,** B.Sc., Ph.D., will retire at the end of this month as research and development director. Dr. Ferguson joined I.C.I. at Billingham in October 1928 and was moved to Widnes in 1932. During the Second World War he was seconded to the Ministry of Supply as Principal Technical Adviser for Chemical Defence. In 1942 he was transferred to Alkali Division as research director, but returned to the General Chemicals Division as its research director in 1950, being promoted to technical managing director in the following year. He was appointed to the I.C.I. board in 1957.

A number of important changes in its internal administration have been announced by the British Welding Research Association. Formerly the association's chief metallurgist, **Mr. P. T. Houldcroft,** B.Sc., F.I.M., becomes head of the newly-formed Welding Technology Department, with **Mr. A. A. Smith,** B.Sc., A.I.M., formerly in charge of the welding process section, as deputy head. Complete administrative responsibility for, and control of, the metallurgical laboratory is assumed by **Mr. H. F. Tremlett,** B.Sc., A.R.S.M., F.I.M., the deputy director of research, with **Dr. R. G. Baker,** M.A., Ph.D., and **Mr. J. G. Young,** B.Sc., as chief metallurgists in charge, respectively, of ferrous and non-ferrous researches. **Dr. A. A. Wells,** B.Sc., Ph.D., A.M.I.Mech.E., assistant director of research, will also direct arc physics and electronics.

After seventeen years with British Ropes Limited, at Gateshead, **Mr. J. R. Stuart** has been appointed wire mill manager of Cables Mexicanos S.A., the British Ropes associate in Mexico. His place as wire mill manager at Gateshead is to be taken by **Mr. E. Errington.**

The appointment is announced of **Mr. Robert Hall** as divisional general manager of a total of four divisions and associate companies within the Plessey Swindon group.

News from Stanley Works (G.B.) Limited is that **Mr. Robert Bradley,** formerly chief planning engineer, has been appointed manager of the engineering department, and that **Mr. Laurence Ford,** chief engineer, is leaving the company to take up a new appointment.

Consultant for the engineering department at the Wythenshawe works of the Associated Electrical Industries Limited transformer division, **Mr. Harold Diggle,** B.Sc., M.I.E.E., has retired after 46 years' service.

Recent appointments made by Tilghman's Limited include that of **Mr. C. F. Williamson** as sales manager of the Compressor Division. The company's sales force has been strengthened by the appointments of **Mr. R. Bushell** to the Lancashire and Yorkshire area, **Mr. A. H. Stenning** to the London area, and **Mr. J. Smith** to the North-East Coast and Scotland.

It is announced by Electrical Remote Control Company Limited that **Mr. A. W. Abbotts** is to be their technical representative for Birmingham, Shropshire, Staffordshire, Derbyshire, Worcestershire, Nottinghamshire, Leicestershire, and Warwickshire. Mr. Abbotts will be located at Castle Bromwich.

Appointed director and general manager of the Tenuous Steel Company Limited, **Mr. Mervyn A. Fudge** has been company secretary of Firth Cleveland Steel Strip Limited since 1956. For the time being he will still retain this position.

The British Iron and Steel Research Association has appointed **Mr. A. G. Shakespeare,** M.A., as head of its steelmaking laboratories at the Sheffield research station.

Appointed group marketing manager of the Amber group of companies, **Mr. D. A. Whyatt** will also continue as manager of the pressurized dispenser division of Amber Oils Limited.

A member of the Plessey group, Ketay Limited announces the appointment of **Mr. K. J. Coleman,** B.Sc., A.M.I.Mech.E., A.M.I.E.E., A.F.R.Ae.S., as chief engineer. Mr. Coleman was previously head of control and instrumentation of the Atomic Energy Department of Babcock and Wilcox Limited.

We are informed that **Mr. R. E. Burrows,** secretary of Acorn Anodising Company Limited, has been appointed to the board of the company.

News from Switzerland is to the effect that **Dr. Alexander Ross** has been appointed European technical representative for M and T Chemicals A.G. Dr. Ross will be located in Zug, Switzerland.

P. T. Houldcroft

A. A. Smith

H. F. Tremlett

Dr. R. G. Baker

J. G. Young

Dr. A. A. Wells

COPPER IN KATANGA

By G. Everwyn

(*Concluded from* METAL INDUSTRY, 17 *November*, 1961)

IN addition to mining and concentration, refining is carried out at a number of metallurgical plants. For the Lubumbashi plants (Elisabethville), the chief source of concentrates is the Prince Leopold Mine (Kipushi concentrator). These concentrates are sintered, roasted and smelted, and the matte so produced converted into blister copper of 98·5 to 99 per cent purity, which is exported to Olen (Antwerp), Belgium, for further refining. The annual capacity is 125,000 metric tons of copper.

The gases from the furnaces pass through cyclone dust collectors and filter bags, and the copper, zinc, lead, cadmium and germanium dusts are collected.

Blister copper production was 120,598 metric tons in 1959 and 121,530 metric tons in 1960.

In the Jadotville Group, the Jadotville-Shituru hydro-metallurgical refinery is one of the most important plants in Katanga. It was started up in 1929 and has a capacity of 145,000 metric tons/yr. of copper and 6,600 metric tons/yr. of cobalt. The concentrates from the Kolwezi and Ruwe concentrators are processed at Shituru to produce copper, which, after refining in an open-hearth furnace, exceeds 99·5 per cent in purity.

Cobalt-bearing solution is bled from the copper circuit to the cobalt electrolysis plant to produce cobalt 99·3 per cent pure.

Electrolytic copper and cobalt production for 1959 were 158,457 metric tons and 6,001 metric tons respectively, and for 1960, 144,689 and 5,413 metric tons.

The Panda electric smelter was built in 1924 and is equipped with four electric furnaces and a rotary refining furnace fired with pulverized coal. It is used mainly to process high-grade cobalt ores. The annual production capacity is about 4,000 metric tons of cobalt.

The smelter is also used to produce a very pure copper suitable for starting sheets.

Copper and cobalt production were: copper: 857 metric tons (1959) and 2,806 metric tons (1960); cobalt (including cobalt from other sources): 2,430 metric tons (1959) and 2,809 metric tons (1960).

Finally, there are the Lead Plant, the Jadotville Central Workshop, Jadotville-Panda Centre, Jadotville Central Laboratory, and the Laboratories of the Research and Testing Department.

In the Kolwezi region is the Luilu copper and cobalt hydro-metallurgical refinery. This is an important new plant and will be discussed later. Production in 1960 was 31,240 metric tons of electrolytic copper.

There are numerous companies in Katanga associated with the Union Minière du Haut-Katanga companies, notably "Metalkat", which produces electrolytic zinc and cadmium and processes the Lubumbashi Smelter flue dusts; "Sogechim", which supplies sulphuric acid to the industry; "Afridex", which produces explosives; and "Sogefor" and "Sogelec", which operate the hydroelectric schemes and distribute the power.

A certain amount of raw materials and semi-finished products are finally refined in Belgium by the Société Generale Metallurgique de Hoboken, which has plants at Hoboken (near Antwerp), Olen and Reppel. (See METAL INDUSTRY, 6 October 1961, p. 277). The Union Minière is a large shareholder in this company.

The Union Minière is also associated with companies in Belgium concerned with the development of nuclear energy, as well as other companies.

The principal markets for Katangan output of copper are Belgium and France, the bulk of the cobalt produced being sold in the United States.

Present Expansion

The western zone, Kolwezi, deposits are described as the "Future of Katanga". These deposits, at present, account for the greater part (nearly three-quarters) of the Katanga copper production, and will play an even more important role in the future, when they are exploited more intensively and as new installations are completed.

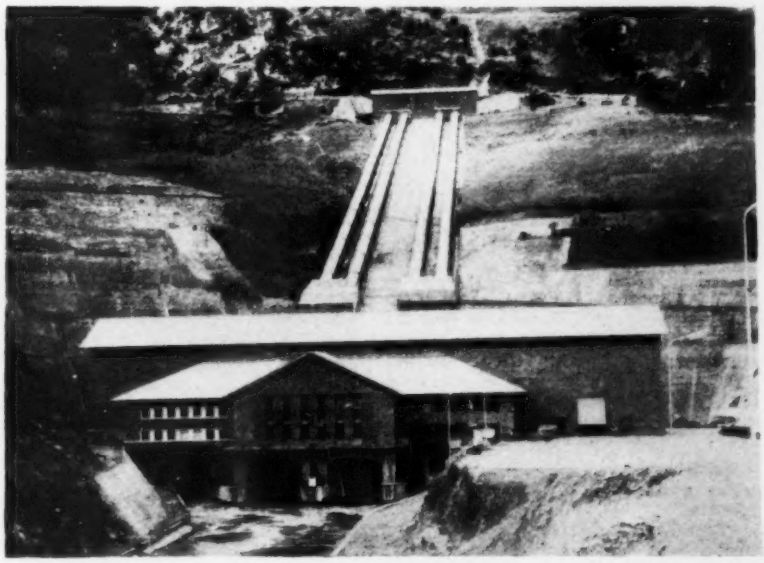
Some important new installations in that region are now described.

The Luilu copper and cobalt refinery is a modern, copper and cobalt hydro-metallurgical refinery near Kolwezi, using the copper oxides and sulphides of the large important mines in that area: Kamoto, Ruwe, Kolwezi and Musonoi.

Full use has been made of automation, the whole installation being remote-controlled from a central dispatching centre. This refinery has been acclaimed to be the most modern and most advanced of its kind in the world.

Construction started in 1955, and the plant was commissioned in April,

Power house of the Le Marinel hydroelectric scheme, the largest in Katanga



Steel headgear for the new shafts at the Kamoto copper and cobalt mine

1960. The total cost of the plant is 2,500,000,000 Katanga francs (£17,857,000).

The first stage has a capacity of 50,000 metric tons/yr. of copper and 1,750 metric tons of cobalt. It was intended to complete the second stage, capacity 50,000 metric tons/yr. of copper by mid-1961. The final capacity is 100,000 metric tons of copper and 3,500 metric tons of cobalt.

In 1960, Luilu produced its first 31,240 metric tons of copper.

Shaft sinking is being carried on at the important Kamoto copper and cobalt mine. The principal ores occurring are copper and cobalt oxides near the surface, and copper and cobalt sulphides below level-400 ft. (ground level assumed zero). There is a transition zone in which both types of ore occur. The ore is about 4 per cent rich in copper. Two ore bodies, each about 40 ft. thick, separated by a 50 ft. thick layer of waste rock, occur, and are about 5,000 ft. long. They continue nearly vertically downwards for about 2,000 ft. and then curve to continue in a horizontal plane for about 2,500 ft.

At present, the seams are worked by opencast methods, the pit being some 200 ft. deep. With increasing depth, the amount of overburden required to be stripped becomes excessive, and the economic limit for this pit has been determined to be 550 ft. Underground methods of mining will have to be employed for the deeper levels and two methods will be used: (i) sub-level stoping where the seams are vertical or near vertical; (ii) room and (long) pillar method where seams are horizontal.

Three (initially) vertical shafts are being sunk at present to an eventual final depth of about 2,000 ft. As the shafts are not urgently required, sinking is only carried out at a rate of about 120 ft/month. The shafts are a 20 ft. diameter service shaft, a 22 ft. diameter hoist shaft and a 22 ft. diameter ventilation shaft. Two stations and crosscuts will link the hoist shaft with the ore body. Underground mining is expected to begin during 1963.

The selection of the method of transporting ore and waste rock from an opencast pit is a question of economics, the three main factors usually being the depth of the pit, the amount of overburden and the quantity of ore available. Every mine is unique and has to be evaluated individually. In the case of the Kolwezi mine, the economic limit for the moving of ore (or waste) with 20 ton Euclid dumpers is 200 ft.

The Kolwezi inclined hoist installation for raising the ore from the deeper levels, consists of a loading platform, inclined track carrying two skips in balance, the head frame and the winder-house.

Twenty-ton Euclid dumpers tip into the bottom-dump skips. The skips travel upwards and discharge into transfer hoppers, which are now moved forward and over by hydraulic rams about a pivot point and discharge into waiting railcars.

The capacity of the installation is rated at 1,400 metric tons/hr. at a vertical depth of 100 metres (70 loads at 20 metric tons each).

The total cost was about 70,000,000 Katanga francs (about £500,000).

The principal copper-producing countries in the world are: the U.S.A., Chile and Canada on the American continents; Katanga and Northern Rhodesia in Africa; the U.S.S.R.

World copper production was 3,650,000 metric tons in 1959 and 4,175,000 in 1960. Of the 1960 figure the American continents produced 2,816,000 and the African continent 809,000. The Communist block produced 520,000 metric tons in 1959 and 550,000 in 1960.

Katanga supplied 301,000 metric tons and Northern Rhodesia 508,000 metric tons, a combined 809,000 metric tons, in 1960. Production both in Katanga and Northern Rhodesia is being increased. In view of the new Luilu refinery, Katanga's production capacity may soon approach 400,000 metric tons. The copper (and mineral) resources of Africa will become increasingly important.

Also of great importance is the cobalt production, of which Katanga supplies about 60 per cent of the world's total.

The workings of the Kamoto copper and cobalt mine near Kolwezi

Industrial News

Home and Overseas

Battery-Operated Lifting Magnet

Under the trade-name of "Magnagrip", a new battery-operated lifting magnet has recently been introduced by **Rapid Magnetic Limited**. This unit is independent of mains supply and unrestricted by power cables. A recessed control panel houses the switch, a safety meter for recharging, and a trickle charger socket for quick, simple connection are provided. Battery capacity provides for a full day's working, and recharging can be done overnight.

Three models of this unit are available, one capable of lifting one ton from a 6 volt supply, one for lifts of two tons from 12 volts, and the third having a three-ton lift from 24 volt supply, all using conventional car-type batteries.

The company states that this unit is of great practical use in machine shops, assembly shops, warehouses, etc., and can be attached to mobile cranes, forklift trucks or static hoist blocks. No special adaptation equipment or modification to existing plant needed.

Aluminium Die-Casting

A £400,000 aluminium die-casting plant is being built for **Rootes Motors (Scotland) Ltd.,** at Linwood, Paisley, and is scheduled to take only 30 weeks to complete. The project involves the erection of a factory building approximately 300 ft. by 180 ft. and 40 ft. high, a single storey service annexe 258 ft. long, 18 ft. wide and 18 ft. high, and an office and amenities annexe of two and three storeys about 180 ft. long, 30 ft. wide and from 26 ft. to 38 ft. high.

The factory building will be of steel-framed construction on part reinforced concrete and part piled foundations. It will have reinforced concrete floor slab, faced brick waist walls, patent glazing and aluminium cladding to sides and north-light roof with metal decking and patent glazing.

Annexes will be of concrete-encased steel-frame construction with reinforced concrete ground floors, precast reinforced concrete suspended floors, roofs of brick, and lightweight concrete block walls and partitions.

The factory will have the most modern machinery and, states the company, will have the first modern high and low pressure die-casting plants in Britain. It will employ some 5,000 workers, and serve industries of all types.

Measuring Lineal Movement

A new instrument for machine shop, toolroom and general mechanical application is now available in the United Kingdom and to Commonwealth countries following a sales agency agreement between the American manufacturers, Southwestern Industries Inc. of California and **Apwar Ltd.** The Trav-A-Dial indicator measures lineal movement in thousandths of an inch. It is designed for use on machine tools to provide a continuous indication of carriage, slide or tool position in relation to work-piece and is equally applicable to numerous mechanisms where lineal movement of one component needs accurate assessment and control in relation to another.

Trav-A-Dial is activated by a gauge wheel contacting a way or machined surface. Motion is transmitted through precision gear trains to a dial graduated in thousandths of an inch and to a secondary dial reading inches and tenths. The latter provides a continuous record of motion up to six inches and repeats, if necessary, to record an infinite length of traverse. A zero return clutch is incorporated.

Aluminium Lecture

At the Science Museum educational lectures for sixth form students and others in London on Tuesday and Wednesday last week, one was given by Dr. E. G. West, technical director of the **Aluminium Development Association.**

His lecture, which included demonstrations, experiments, film excerpts and slides, covered the chemical background of aluminium, its production, physical and mechanical properties, principal metallurgical properties, and an indication of its widespread uses in engineering.

Services for Storekeepers

For more than two years now the **Purchasing Officers Association** has sponsored a one-year examination course leading to the P.O.A. Certificate in Storekeeping. In the first year 406 students took the course, of whom 237 were awarded certificates. In the second year, 262 students were examined and 167 gained certificates.

In view of the interest of storekeepers in these certificate exams, the P.O.A. has increased its services to them. At the association's recent annual general meeting it was proposed that the association keep a register of the names and other prescribed particulars of all persons to whom the certificate is awarded, and that all persons whose names remain on the register be classified as certificated storekeepers, although not members of the association. The resolution was approved.

Now, registered storekeepers may be attached to an existing P.O.A. branch and attend three storekeeping meetings a year. They will also have the right to consult P.O.A. headquarters on storekeeping problems and be eligible to use the appointments register service conducted by the P.O.A. They will also be advised of any course in the stores field which may be sponsored by the P.O.A. The subscription for these services will be £1 10s. 0d. per annum.

One-Bath Cleaning

According to news from **Grant and West Ltd.,** degreasing derusting and descaling of ferrous metals can now be done simultaneously in one tank. This is due to two new solutions developed by the company. These two solutions are known as "ChemiClene No. 437", for the removal of oil, grease, light rust and welding scale, and "ChemiClene No. 447" for removing oil, grease, heavy rust, welding scale and mill scale. Both solutions work on the same lines.

Diluted with water and heated to between 40° and 50°C., the makers say these solutions emulsify the oil and grease so that they are completely removed in the following water rinse. At the same time, rust and scale oxides are removed by chemical action. The solution No. 437 is said to be additionally non-corrosive, and is therefore particularly suitable for the treatment of partially fabricated work where some of the liquid could be trapped between seams, spot welds, and so on.

Companies Merge

It has been announced by the chairman of **Airtech Limited** and **Chartair Limited** that these two companies are to merge, all the undertaking, assets and business of the latter company having been acquired by Airtech Ltd., whose capital has been increased to £250,000.

The combined businesses, which cover a wide range of activities in the fields of engineering, aircraft and electronics, will henceforth be carried on by Airtech.

Mineral Developments

What is claimed to be the most advanced mineral treatment plant in Europe is being established in Derbyshire by the **Laporte Industries Group,** with an initial annual capacity of 20,000 tons of acid grade fluorspar, between 6,000 and 8,000 tons of barytes and 1,000 tons of lead.

The plant is at the site of The Cupola Mining and Milling Company Limited, the company which Laporte acquired last year and whose operations are carried out close to those of Glebe Mines Limited, at Eyam, Derbyshire.

Metal Finishing

In the metal finishing division of the National Maintenance Exhibition, held in London last week, an interesting exhibit was provided by **The Pyrene Company Limited,** who featured the following items on their stand: a range of Pyroclean metal cleaners; Pyroclean 201, a derusting and descaling process; Preperite, a derusting solution to be applied by swab or immersion; Paste Preperite, a thixotropic material ideal for spot derusting; Parker Finishes P45B and P45C; Spray Gun Bonderite; Pultac, an easily strippable material which acts as a barrier between spray booth walls and overspray paint; and Detac, a paint denaturing material for the treatment of recirculating water in water wash spray booths.

Annual Dinner

On Thursday of last week the annual dinner of the **Association of Light Alloy Refiners and Smelters** was held at the Trocadero Restaurant, London, presided over by Mr. W. W. Kee, chairman of the association. Among the guests present on this occasion were officers from the Ministry of Aviation, the Board of Trade, the Light Metal Founders' Association, Sir Geoffrey Bourne, G.C.B., K.B.E., C.M.G. (director-general of the Aluminium Development Association), Mr. S. E. Clotworthy, C.B.E. (chairman of the Aluminium Industry Council), Mr. E. C. Mantle (British Non-Ferrous Metals Research Association), and Mr. A. G. Robinson (National Association of Non-Ferrous Scrap Metal Merchants).

After the Loyal Toast had been honoured, Dr. E. G. West, Ph.D., B.Sc.,

F.I.M., proposed the toast of "The Association", which was replied to by Mr. W. W. Kee. In his reply, the chairman referred to the fact that during the past year the association had been strengthened by the addition of the British Aluminium Company to membership, and the association had also taken an important and historical step by joining the Organization of European Aluminium Smelters. The association was, in fact, the largest entity in this federation, and this could well prove to be of inestimable value if Great Britain joined the Common Market.

In emphasizing the fact that the association was indisputably the best technically-equipped association of smelters anywhere in the world, Mr. Kee said that commercially they must surely be the weakest. This year, he said, they had again been bedevilled by instability, and by the inability of the industry to cope with rapidly changing market conditions. Unless we can now, he continued, apply to our commercial affairs some of the intelligence which has made us technically predominant, "we may find ourselves unable to fulfil not only our obligation to the European smelters, but also our obligations to our shareholders, our employees and our industry".

Mr. Kee then went on to say that it was his hope that, before handing over to his successor in the chair next April, they would have taken steps to remedy the devastating weakness of their commercial affairs. In his concluding remarks, Mr. Kee expressed his thanks to those who had been of such great help to him during his year of office, including Mr. Frank Farenden, Dr. Jakobi and Mr. M. Smith.

The toast of "The Guests" was proposed by Mr. P. F. Milward, and response was made by Mr. W. W. Abson (assistant secretary/Air A2, Ministry of Aviation).

Visiting Scotland

Scottish members of the **Association of Bronze and Brass Founders** are to have an opportunity of meeting the President of the Association, Mr. W. R. Buxton. A meeting has been arranged for Tuesday next, November 28, at the St. Enoch Hotel, Glasgow, commencing with luncheon at 12.30 p.m. and the meeting to follow.

Postgraduate Courses

Advance notices have been given of two postgraduate short courses which have been arranged by the Department of Metallurgy, College of Advanced Technology, Birmingham. The first course of ten lectures is planned for successive Tuesday evenings commencing on January 23 next year, at 6.30 p.m. The subject is "Modern Developments in Extrusion". The lectures, which will be given by a number of specialists in this field, will include critical surveys of theoretical aspects, recent developments in the extrusion of steels and of non-ferrous metals generally. In addition to more conventional processes, the specialized techniques for the newer metals will also be discussed.

The other course deals with "Modern Developments in Cast Iron", and will be held on successive Wednesdays, commencing on January 24 next year at 6.30 p.m. Full details of both these courses may be obtained from the College at Gosta Green, Birmingham, 4.

Forthcoming Meetings

November 24—Institute of Metal Finishing. Sheffield and North-East Branch. Grand Hotel, Sheffield. "Hard Chrome Plating." C. F. Corfe. 7 p.m.

November 24—Institution of Electronics. Reynolds Hall, The Manchester College of Science and Technology, Sackville Street, Manchester. "Silicon Controlled Rectifiers and Their Applications." 7 p.m.

November 28 — Society of Instrument Technology. Manson House, Portland Place, London, W.1. "Automatic Plant Analysis by Electrochemical Methods." R. F. Rodger. 6.30 p.m.

November 29 — Southampton Metallurgical Society. Southampton Technical College. "Organic Detecting and Elimination of Gases in Cast Metals." Dr. D. V. Atterton. 7.15 p.m.

Mineral Treatment Plant

A complete modern mineral treatment plant, installed at the Avonmouth works of the National Smelting Company Ltd., has been acquired by **George Cohen Sons and Company Ltd.** for resale.

The plant comprises a materials handling system followed by jaw, Kennedy, gyratory and rolls crushing equipment of large capacity, with materials storage and feeding plant to four rotary kilns by Ernest Newell. Two of these are 160 ft. long by 11 ft. 3 in. dia., and the remaining two are 135 ft. by 8 ft. 2 in. and 80 ft. by 6 in. respectively. They are designed for pulverized coal firing. The residues from the principal kilns pass through conveyors to storage bunkers.

Metallic fume from the kilns is collected in a very large automatically shaken bag plant by Power Gas Corporation comprising five separate units contained in a building, each unit capable of handling 25,000 ft^3/min., together with the entire dust collecting and removing equipment. The handling belt, comprising belt conveyors, screw conveyors, elevators, etc., was supplied by Spencers, Melksham Ltd.

Troubles Over

It is learned from **Platt Metals Ltd.** that they have been able to announce that the labour trouble they have had at their works for the past six months is now over.

It has been a long and hard struggle, and the company wish to say they are grateful to their many friends from whom they received co-operation during the troublous period.

Melting Furnace Contract

An order for a Wild-Barfield NRC type 2551-B vacuum induction melting furnace which has a capacity of 12-17 lb. molten steel, or an equivalent volume of other metals, has been received by **Wild-Barfield Electric Furnaces Ltd.** from Bristol Siddeley Engines Ltd., of Filton.

Power is supplied by a 30 kW motor generator set, and the pumping system is designed to give pressures down to 10^{-3} mm. Hg. The furnace is being supplied with a booster diffusion pump with provision later for the addition of a high vacuum diffusion pump for melting at pressures of less than 10^{-3} mm. Hg. if required.

The design of the furnace includes provision for viewing, charging, alloying, pouring, cover lifting and bridge breaking, as well as means of measuring melt temperature. A bulk charging chute of 40 in^3 capacity is provided. In operation, melting time for a charge of steel is less than 30 min., and although the unit could well be used for production work in batches, it finds its main application as a laboratory equipment for studying and developing metals and alloys, the properties of which can be improved *in vacuo*.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week rose by 11 tons to 4,346 tons, comprising London 1,150, Liverpool 1,786 and Hull 1,410 tons.

Copper stocks fell 126 tons to 15,089 tons, distributed as follows: London 400, Liverpool 12,839, Birmingham 50, Manchester 1,525, Hull 250, and Glasgow 25 tons.

Lead duty-free stocks rose 926 tons to 8,183 tons, comprising London 7,633, Glasgow 300, Swansea 100, and Manchester 150 tons. In-bond stocks fell 16 tons to 3,436 tons, all in London.

Zinc duty-free stocks rose 370 tons to 8,234 tons, comprising London 2,403, Glasgow 81, Hull 325, Manchester 300, Liverpool 50, and Avonmouth 5,075 tons. In-bond stocks fell 62 tons to 2,923 tons, all in London.

An Acquisition

It has been reported from Bremen that Aluminium-Werke G m.b.H. of Nuremburg, a subsidiary of Aluminum Company of Canada, has acquired the light metal works of the Borgward group in Uphusen. Production by the new company at Uphusen has started.

Tin Consumption in U.S.A.

According to the U.S. Bureau of Mines, tin consumption in the U.S. decreased ten per cent in September 1961. Tin used during the month totalled 6,480 long tons and comprised 4,245 tons of primary pig tin and 2,235 of secondary and imported tin-base alloys.

August consumption of tin was 7,210 tons—4,570 of primary and 2,640 of secondary and imported tin-base alloys. The Bureau of Mines said total U.S. industry tin stocks increased from 39,730 long tons on September 1 to 41,800 tons on September 30, 1961.

Copper and Copper Alloy Castings

It is reported that the **Association of Bronze and Brass Founders** has seized the opportunity presented by the issue of a revised British Standard Schedule of Copper Alloy Ingots and Copper and Copper Alloy Castings, to publish—primarily for distribution to its members—a companion volume to the Standard which is a guide to the alloys, their uses, properties and casting characteristics.

This companion volume, which has been compiled by experts in their respective fields, contains sections as follows:—(a) guide to alloy selection; (b) typical physical and mechanical properties; (c) casting methods; (d) summary of the specifications; (e) equivalent specifications; (f) alloy groups; and (g) photomicrographs of typical alloy structures.

Copies of this volume may be purchased from the secretaries of the association at 69 Harborne Road, Edgbaston, Birmingham, 15, price one guinea, post paid.

Stress Analysis Techniques

Nine engineers and physicists from five overseas countries have been attending a British Council course in stress analysis techniques during these past two weeks. Centred on London, the course is

the first on the subject to have been arranged by the Council. It is designed to give an introduction to experimental stress analysis for engineers and physicists from overseas.

The course was divided into the study of photoelasticity, electrical resistance strain gauges, and other methods of stress analysis. Lectures were held at the Institution of Mechanical Engineers in London, and short visits were arranged to the Mechanical Engineering Laboratory, Cambridge; Rolls-Royce Ltd., at Derby; the Motor Industry Research Association, at Nuneaton; and the National Physical Laboratory at Teddington. Course members came from Iran, Italy, the Netherlands, Norway and Turkey.

News from Scotland

Acquisition of the sole U.K. rights for the manufacture of the Hein, Lehmann and Co., A.G., of Düsseldorf, "continuous flow" centrifugal equipment enables **Watson, Laidlaw and Company Ltd.**, of Glasgow, to complete the range of semi-automatic, fully automatic and continuous centrifugals manufactured by the Glasgow concern, for industrial purposes.

The agreement between the two companies provides for close co-operation and exchange of technical information with the object of increasing efficiency of centrifugal equipment. The Lehmann British-built equipment will be marketed exclusively by the Glasgow firm in the U.K. and in a number of overseas markets.

Scrap Merchants' Meeting

On Tuesday, December 5 next, the half-yearly general meeting of the **National Association of Non-Ferrous Scrap Metal Merchants** will be held at the Midland Hotel, Birmingham, commencing at 11.30 a.m.

Among the items for the agenda are the following: (a) the report of the President; (b) to consider and, if thought fit, approve the recommendation of the Council that the annual subscription for 1962 be £9; and (c) any other business.

Challenge of Automation

"The sooner a Department of Automation is established in this country, the better. Industrial experience has always shown that unless somebody is given the responsibility for the development of a science or technology, progress very nearly marks time."

This was said by Mr. Landon Goodman, B.Sc.(Eng.)(Lond.), A.R.T.C.S., A.M.I.Mech.E., A.M.I.E.E., industrial specialist of the Electrical Development Association, at the Century Hotel, Wembley Park, on Wednesday last, when addressing the North West Middlesex branch of the **British Institute of Management.**

Mr. Landon Goodman was elaborating on a suggestion he had recently made at the National British Institute of Management Conference, and he said he was conscious of a great deal of support for his idea in managerial, trade union and research association circles. He went on to say that a department of automation would be organized on a national basis, representative of trade unions, management and the Government, to deal with the problems that automation might bring to industry.

A Scientific Occasion

Advance notice is given by the **Institute of Physics** and the **Physical Society** of the 1962 Annual Exhibition, which will be held in the Old and New Halls of the Royal Horticultural Society, Westminster, London, S.W.1, from Monday, January 15, to Friday, January 19. Admission to the exhibition will be by ticket only. Application for tickets should be made to the Secretary, 47 Belgrave Square, London, S.W.1.

Sole Distributors

An announcement has been made by **Volspray Limited** to the effect that the company have been appointed sole distributors in the United Kingdom for the "Aro" Hydra-coat airless spraying equipment, of which there are a number of models available.

Aluminium Building Service

A major extension of the British Aluminium Building Service came into operation on Thursday last as a co-operative effort by the **British Aluminium Company Limited** and many manufacturers of aluminium building projects. The service, inaugurated in July this year, provides information for architects through a comprehensive technical manual on the uses of aluminium in the building industry.

Now the service has been extended to cover all quantity surveying and consulting engineering practices, which has now received a complete set of the data sheets from the manual giving detailed technical information on many aluminium building products.

The data sheets are to A4 size, classified by S.f.B. and U.D.C. systems, thus conforming to the Royal Institute of British Architect "S.f.B/U.D.C. Building Filing Manual — Recommendations for Standard Practice in Proclassification and Filing", published last month.

News from Birmingham

Consumers are taking up moderate supplies of raw material in the metal industries in Birmingham and the Midlands, but little development is expected

Metal Statistics

Detailed figures of the consumption and output of non-ferrous metals for the month of September, 1961 have been issued by the British Bureau of Non-Ferrous Metal Statistics, as follows in long tons:—

COPPER	Gross Weight	Copper Content
Wire	26,640	26,184
Rods, bars and sections	13,833	9,051
Sheet, strip and plate	13,744	10,906
Tubes	7,894	7,298
Castings and miscellaneous	7,529	—
Sulphate	1,746	—
	71,380	60,028
Of which:		
Consumption of Virgin Copper		45,813
Consumption of Copper and Alloy Scrap (Copper Content)		14,215

LEAD	
Cables	8,833
Batteries	2,753
Battery Oxides	3,047
Tetra Ethyl Lead	1,878
Other Oxides and Compounds	1,919
White Lead	814
Shot	389
Sheet and Pipe	6,205
Foil and Collapsible Tubes	377
Other Rolled and Extruded	565
Solder	1,397
Alloys	1,634
Miscellaneous Uses	1,549
Total	31,359

TIN	
Tinplate	776
Tinning:	
Copper Wire	59
Steel Wire	9
All other	71
Solder	223
Alloys	499
Foil and Collapsible Tubes, etc.	63
Tin Compounds, Salts, and Miscellaneous Uses	149
Total Consumption	1,849

ZINC	
Galvanising	7,699
Brass	9,269
Rolled Zinc	2,352
Zinc Oxide	2,047
Zinc Die-casting alloy	5,375
Zinc Dust	1,100
Miscellaneous Uses	936
Total, All Trades	28,778
Of which:	
High purity 99·99 per cent	5,855
Electrolytic and high grade 99·95 per cent	4,465
Prime Western, G.O.B. and debased	11,325
Remelted	494
Scrap Brass and other Cu alloys	3,843
Scrap Zinc, alloys and residues	2,623

ANTIMONY	
Batteries	107
Other Antimonial Lead	41
Bearings	22
Oxides—for White Pigments	80
Oxides—other	78
Miscellaneous Uses	13
Sulphides	7
Total Consumption	348
Antimony in scrap	
For Antimonial Lead	333
For Other Uses	25
Total Consumption	358

CADMIUM	
Plating Anodes	47·35
Plating Salts	11·75
Alloys: Cadmium Copper	4·30
Alloys: Other	4·90
Batteries: Alkaline	4·85
Batteries: Dry	0·40
Solder	11·45
Colours	28·25
Miscellaneous Uses	2·15
Total Consumption	115·40

during the remainder of the year. Electrical industries are taking up a fair amount of copper as the firms engaged on heavy electrical engineering are well supplied with orders in connection with power stations at home and abroad. The motor trade is using a substantial amount of raw material and extra shifts have been put on at some works recently to cope with export business. Home trade, however, continues slack. Retail sales of domestic household goods are declining in some areas.

Most of the iron foundries have spare capacity, particularly for the production of light castings. There is a fairly good call for the heavier type of casting for the engineering industry. Shipbuilding demands are slow and the railways show no indication of increasing their contracts. Activity continues high in regard to structural engineering, and a substantial tonnage of steel is being delivered against contracts, particularly for joists, sections and bars. Plate mills are fairly well situated for orders over the current quarter. Re-rollers are able to obtain semi-finished steel promptly from British mills.

Malayan Tin

Tin shipments in the first half of November amounted to 3,504 tons from Penang, the Straits Trading Company announced. This compared with 2,249 tons in the first half of October. The latest figure comprised United Kingdom 120 tons, U.K. options 15, United States 1,295, the European Continent 1,119¼, Canada nil, Pacific 41¼, India 247, South America 72, Africa 10, Australasia 5, Middle East 10½ and Japan 568.

Shipments from Singapore during the first half of November totalled 2¼ tons, compared with 7½ in the first half of October. The Pacific received 2½ tons and the Middle East ¼ ton.

Aluminium Co-operation

Close co-operation has been agreed upon between Aluminium - Industrie-Aktiengesellschaft of Zurich and the Swedish virgin aluminium producer Aktiebolaget Svenska Aluminium-Kompaniet, it is reported from Zurich. The Swiss company will render technical advice to Svenska Aluminium-Kompaniet and make available the plans of its latest electrolytic furnaces. This will enable the Swedish company to increase its capacity by 17,500 tons annually.

West German Industry

According to news from Düsseldorf, orders received by the non-ferrous metals industry of North Rhine-Westphalia, Germany's largest industrial concentration, declined during the third quarter of this year by an even more marked extent than in the first six months. The very large accumulation of orders, held by manufacturers of non-ferrous metal semi-products, is now being gradually reduced, while users of such semi-products are also clearing their stocks. As a result, orders are now 30 per cent below the level in the third quarter of 1960 when the boom was at its peak.

In view of this trend, producers of non-ferrous metal semi-products have cut down their output to a normal level, a report issued by the North Rhine-Westphalian Ministry of Economics states. Average production per working day during the third quarter was three per cent below last year's level.

Company Reports

Birkett, Billington & Newton

Net profit, year to July 31, 1961, £58,570 (£29,585), and dividend 15 per cent (12½ per cent). Fixed assets £274,747 (£259,356), current assets £417,151 (£350,798), and liabilities £194,520 (£176,853).

International Nickel of Canada

This company and its subsidiaries report that in the nine months ended September 30, 1961, net earnings in terms of U.S. currency amounted to $58,232,000, equal to $1·98 per common share. This compares with $62,685,000, equal to $2.14 per share in the same period of 1960. The company said continuing increases in labour and services costs and a lower price for copper affected earnings unfavourably in the first nine months of this year. However, favourable factors included an increase in demand for nickel and also an increase in the company's price for the metal.

W. and J. Lawley

Group net profit, year to July 31, 1961, £122,699 (£98,170), subject to tax £65,400 (£48,947). Dividend is 25 per cent (same equivalent, including bonus). Fixed assets £305,743 (£148,037). Current assets £408,434 (£382,466). Goodwill £145,282 (nil). Current liabilities £339,032 (£173,356), including overdraft £33,632 (nil). Commitments £22,500.

Trade Publications

Bodybuilding in Aluminium. — Alcan Industries Limited, Banbury, Oxfordshire.

A series of four books dealing with this subject are available from the above company. Book No. 1 deals with materials and general practice, book 2 with platform and truck bodies, book 3 with pantechnicons and box vans, and book 4 with tippers. In addition, Alcan industries provide wall-charts showing aluminium sections and castings for bodybuilding.

Cyclone Furnaces.—Efco Furnaces Ltd., Queens Road, Weybridge, Surrey.

An illustrated brochure, descriptive of the Efco-Lindberg Cyclone furnaces has been produced by the above company. Statistical data and charts, as well as photographs are included in the details given.

Process Plant and Equipment. — The Power-Gas Corporation Limited, P.O. Box 21, Stockton-on-Tees.

This is a book of photographs illustrating plant and equipment typical of that completed by this company for the chemical, petroleum, petrochemical, gas and nuclear energy industries. The photographs include some taken of installations in India, South Africa, Europe, Canada, Spain, Japan, Australia, as well as in the United Kingdom, and amply illustrates the wealth of "know-how" accumulated by the corporation in over eight years' experience in process design and engineering techniques.

New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons Limited, Company Registration Agents, Chancery Lane, W.C.2.

Ingram and Russell Limited (704808), 34 Margaret Street, Walsall. Registered October 4, 1961. To carry on the business of iron, steel and non-ferrous metal merchants, etc. Nominal capital, £2,000 in £1 shares. Directors: Edward W. Ingram, Nellie Ingram, Eric G. Russell and Lilian I. Russell.

J. A. Smith (London) Limited (704824), 63 Popham Road, N.1. Registered October 4, 1961. To carry on the business of metal welders, etc. Nominal capital, £100 in £1 shares. Directors: John A. Smith and Stanley Aarons.

Amalgamated Sprays Limited (705096), Woodgreen Road, Waltham Abbey, Essex. Registered October 6, 1961. To carry on the business of enamellers, sprayers, anodizers, etc. Nominal capital, £1,000 in £1 shares. Directors: Ronald P. Bone and Dennis S. Bennett.

Lugsdale Scrap Metal and Demolition Engineers Limited (705161), Lugsdale Road, Widnes. Registered October 9, 1961. To take over the business of metal dealers carried on by Lugsdale Scrap Metal Co. at Warrington Road, Widnes, etc. Nominal capital, £3,000 in £1 shares. Directors: Joseph Jackson, John A. Jackson, Harold V. Hunt and Veronica Hunt.

Sheet Metal Prefabricators (Battersea) Limited (705429), 33a Home Road, S.W.11. Registered October 11, 1961. To carry on the business of copper, aluminium and zinc roofing contractors, etc. Nominal capital, £100 in £1 shares. Directors: Donald Leigh and Frederick Durbridge.

Lamp Metals Limited (706083), Marnet House, Kingsway, W.C.2. Registered October 19, 1961. To acquire part of the undertakings of A.E.I. Lamp and Lighting Company Ltd. and of The General Electric Company Ltd.; to carry on business of manufacturers of and dealers in metal and metal alloys and articles made therefrom, etc. Nominal capital, £750,000 in 200,000 "A" Ord., 200,000 "B" Ord., and 350,000 "C" Ord. shares of £1 each. Directors not named.

Mercon Metals Limited (706022), 38 Great Portland Street, W.1. Registered October 19, 1961. Nominal capital, £100 in £1 shares. Directors: Bernard Conway and Merna Conway.

Metbak Limited (706158), Gladstone House, Crook, Co. Durham. Registered October 20, 1961. To carry on the business of metal and machinery merchants, etc. Nominal capital, £1,000 in £1 shares. Directors: George W. Robinson and Hugh Dodd.

Metal Market News

DETAILS of activity in the non-ferrous industry in this country during September have been issued by the British Bureau of Non-Ferrous Metal Statistics which show, as might be expected, that activity increased again following August, the holiday month. In copper, consumption of all grades amounted to 60,028 tons, of which about 14,000 tons was in the form of scrap. This total compared with 40,920 tons in the previous month. Stocks stood at 147,948 tons at September 30, about 3,000 tons lower than a month earlier. In lead, total usage was 31,359 tons, against 24,816 tons in August, while stocks at 74,273 tons were 600 tons down. Consumption of zinc, including secondary metal, was 28,778 tons, compared with 21,501 tons in August, while stocks declined from 70,637 tons at August 31 to 69,491 tons at the end of September. Tin followed a similar pattern, for at 1,849 tons consumption was up by 400 tons. These September figures are quite favourable and confirm the idea that business in non-ferrous metals in the U.K. is maintained at a good level. It must, however, be said that the brass side is somewhat off, although here the reduction is probably not more than about 10 per cent below normal. This, of course, affects zinc, but what is worse for zinc is the falling off in activity over the past few years in the galvanizing side of the zinc industry.

Trading in zinc futures last week was fairly brisk, for the turnover amounted to nearly 10,000 tons. Following a reported increase of 255 tons in L.M.E. stocks to 10,849 tons, the price weakened until cash touched £67 5s. 0d. and three months £68 15s. 0d., at which level some recovery took place. Finally, after a somewhat depressing week, cash closed 10s. down at £68 5s. 0d., and three months 5s. lower at £69 10s. 0d. Opinion seems to be somewhat divided about the future course of zinc values, but it has been a truism for some years in market circles that zinc below £70 is cheap. Unfortunately, there is far too much zinc in sight and high grade premiums have come down during the past months. The Geneva conference brought no help to either lead or zinc, and it is very difficult to foresee much improvement in the value of either of these metals. Lead was just as weak as zinc, and at one time cash was down to £58 10s. 0d. and three months to £59 12s. 6d. A recovery followed, and at the close the two quotations were 12s. 6d. lower on balance at £59 5s. 0d. cash and £60 7s. 6d. forward. The turnover was 10,300 tons. L.M.E. stocks were up 284 tons to 10,709 tons.

Tin stocks in official warehouses advanced by 116 tons to 4,335 tons and, on the week's trading, the contango widened to £5 10s. 0d. The turnover amounted to 1,715 tons, and at the close cash had lost £3 at £969, while three months was 30s. up at £974 10s. 0d. Consumer demand has been reported as fairly good, but sentiment is not very bullish although in some quarters £1,000 is still being tipped as the ultimate top for this metal. Much depends on what course the United States authorities are going to pursue in January, when Congress meets again. Including transactions put through on the Kerb, last week's turnover in copper exceeded 10,000 tons, but very little change in price was seen from the previous Friday, when trading came to an end. On balance, cash was up by £2 at £229 10s. 0d., and three months £1 15s. 0d. higher at £229 5s. 0d. Stocks in official warehouses fell by only 120 tons to 15,215 tons, so that it looks as though the programme of shipments abroad was concluded.

New York

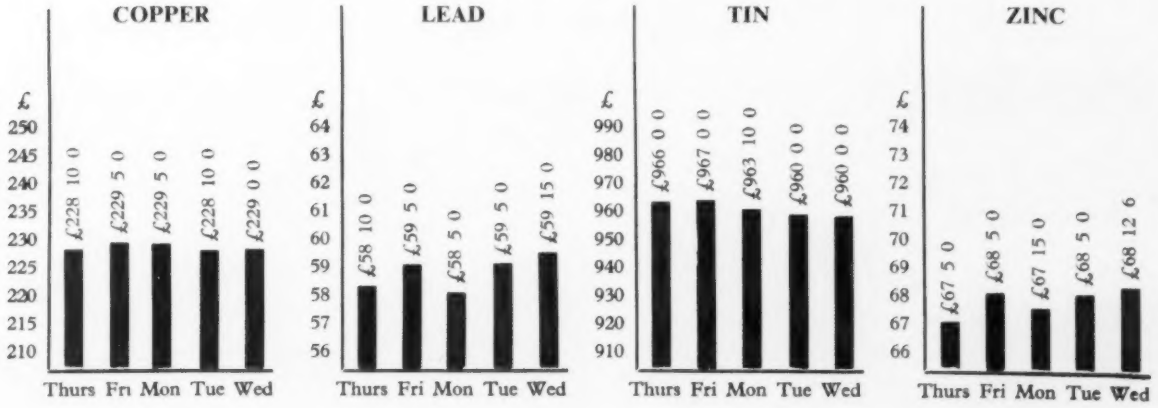
At the week-end, copper futures were modestly active. Prices were about on par to a little higher. There was little or no feature to the market. Physical copper also was quiet. Large producers and custom smelters were doing routine business, mostly for November. Scrap copper also was slow but all custom smelters are now at one price, 24·75 cents/lb. In the outside market, nearby copper was reported available at 30½ cents/lb. Export copper was dull and nominally quoted at 29·25 cents/lb. Lead was quiet, while business for zinc was described as modest.

Locally, tin prices were marked slightly higher, reflecting steadier levels reported from abroad, but demand left much to be desired. Spot tin offered was at 123¾ cent/lb., prompt and December at 123⅝, January at 123¼, February at 123 and March at 122⅞ cents/lb.

The American Smelting and Refining Company has officially opened its new Mission mine near Tucson which, company officials said, should help lift Asarco to the status of a major copper producer. Officials said the new mine, with its near current rate of 45,000 short tons annually plus copper mined from other company sources, will give Asarco a total production of about 200,000 short tons a year. The mine was completed six months ahead of schedule at a cost of $34,000,000. Mr. Simon D. Strauss, Asarco's vice-president, indicated that the development of the Mission mine, and a search for other copper ore deposits in Arizona and other areas denoted the company's confidence in the copper outlook.

London Metal Exchange

Thursday 16 November to Wednesday 22 November 1961



C

NON-FERROUS

PRIMARY METALS

All prices quoted are those available at 2 p.m. 22/11/61

		£	s.	d.
Aluminium Ingots	ton	186	0	0
Antimony 99·6%	„	237	10	0
Antimony Metal 99%	„	230	0	0
Antimony Oxide Commercial	„	194	10	0
Antimony White Oxide	„	212	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		11	6
Calcium	„	2	0	0
Cerium 99%	„	18	0	0
Chromium	„		6	11
Cobalt	„		12	0
Columbite per unit			8	10	0
Copper H.C. Electro	ton	229	0	0
Fire Refined 99·70%	„	228	0	0
Fire Refined 99·50%	„	227	0	0

		£	s.	d.
Copper Sulphate	ton	78	0	0
Germanium	grm.		—	
Gold	oz.	12	9	11½
Indium	„		10	0
Iridium	„	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	59	15	0
Magnesium Ingots	lb.			
99·8%	„		2	2½
99·9+%	„		2	3
Notched Bar	„		2	9½
Powder Grade 4	„		5	6
Alloy Ingot, AZ91X		1	11½-2	1½
Manganese Metal	ton	280	0	0
Mercury	flask	59	0	0
Molybdenum	lb.	1	15	0
Nickel	ton	660	0	0
F. Shot	lb.		5	11
F. Ingot	„		5	11
Osmium	oz.	20	0	0
Osmiridium	„		—	

		£	s.	d.
Palladium	oz.	9	0	0
Platinum	„	30	5	0
Rhodium	„	46	0	0
Ruthenium	„	16	0	0
Selenium	lb.	2	6	6
Silicon 98%	ton	123	0	0
Silver Spot Bars	oz.		6	8
Tellurium Sticks	lb.	2	0	0
Tin	ton	960	0	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	69	5	7½
Dust 95/97%	„	112	0	0
Dust 98/99%	„	118	0	0
Granulated 99+%	„	94	5	7½
Granulated 99·99+%	„	105	13	9

**Duty and Carriage to customers' works for buyers' account.*

INGOT METALS

All prices quoted are those available at 2 p.m. 22/11/61

Aluminium Alloy (Virgin)	£	s.	d.
B.S. 1490 L.M.5 ton	nom.		
B.S. 1490 L.M.6 „	„		
B.S. 1490 L.M.7 „	„		
B.S. 1490 L.M.8 „	„		
B.S. 1490 L.M.9 „	„		
B.S. 1490 L.M.10 „	„		
B.S. 1490 L.M.11 „	„		
B.S. 1490 L.M.12 „	„		
B.S. 1490 L.M.13 „	„		
B.S. 1490 L.M.14 „	„		
B.S. 1490 L.M.15 „	„		
B.S. 1490 L.M.16 „	„		
B.S. 1490 L.M.18 „	„		
B.S. 1490 L.M.22 „	„		
Aluminium Alloys (Secondary)			
B.S. 1490 L.M.1 ton	144	0	0
B.S. 1490 L.M.2 „	145	0	0
B.S. 1490 L.M.4 „	154	0	0
B.S. 1490 L.M.6 „	170	0	0
***Aluminium Bronze**			
BSS 1400 AB.1 ton	237	0	0
BSS 1400 AB.2 „	245	0	0

		£	s.	d.
***Brass**				
BSS 1400-B3 SCB2	ton	176	0	0
BSS 249	„	172	0	0
***Gunmetal**				
B.S. 1400: LG2 d/d	„	209	0	0
B.S. 1400: LG3 d/d	„	220	0	0
B.S. 1400: GI 1½ Pb d/d	„	279	0	0
B.S. 1400: GI ½ Pb d/d	„	293	0	0
***Manganese Bronze**				
BSS 1400 HTB1	„	192	0	0
BSS 1400 HTB2	„	211	0	0
BSS 1400 HTB3	„	227	0	0
Nickel Silver				
Casting Quality 12%	„	255	0	0
„ „ 16%	„	265	0	0
„ „ 18%	„	310	0	0
***Phosphor Bronze**				
B.S.1400P.B.1.(A.I.D. released)	„	313	0	0
B.S. 1400 L.P.B.1	„	235	0	0

**Average prices for the last week-end.*

Phosphor Copper	£	s.	d.
10% ton	251	0	0
15% „	254	0	0
Phosphor Tin			
5% „	1046	0	0
Silicon Bronze			
BSS 1400-SB1 „	275	0	0
Solder, soft, BSS 219			
Grade C Tinmans „	427	0	0
Grade D Plumbers „	336	15	0
Grade M „	472	0	0
Solder, Brazing, BSS 1845			
Type 8 (Granulated) lb.		—	
Type 9 „		—	
Zinc Alloys			
BSS 1004 Alloy A ton	99	3	9
BSS 1004 Alloy B „	103	3	9
Sodium-Zinc lb.		2	5½

SCRAP METALS

Merchants' average buying prices delivered, per ton, 21/11/61

Aluminium	£
New Cuttings	134
Old Rolled	98
Segregated Turnings	72
Brass	
Cuttings	154
Rod Ends	139
Heavy Yellow	131
Light	126
Rolled	142
Collected Scrap	128
Turnings	132

Copper	£
Wire	205
Firebox, cut up	203
Heavy	197
Light	192
Cuttings	208
Turnings	194
Braziery	162
Gunmetal	£
Gear Wheels	196
Admiralty	196
Commercial	175
Turnings	170

Lead	£
Scrap	49
Nickel	
Cuttings	—
Anodes	590
Phosphor Bronze	
Scrap	175
Turnings	170
Zinc	
Remelted	62
Cuttings	51
Old Zinc	32

METAL PRICES

SEMI-FABRICATED PRODUCTS

Prices vary according to dimensions and quantities. The following are the basic prices for certain specific products

		£	s.	d.
Aluminium				
Sheet 10 S.W.G.	lb.		2	10½
Sheet 18 S.W.G.	,,		3	0½
Sheet 24 S.W.G.	,,		3	3½
Strip 10 S.W.G.	,,		2	10½
Strip 18 S.W.G.	,,		2	11½
Strip 24 S.W.G.	,,		3	1
Circles 22 S.W.G.	,,		3	4½
Circles 18 S.W.G.	,,		3	3½
Circles 12 S.W.G.	,,		3	2½
Plate as rolled	,,		2	10
Sections	,,		3	4
Wire 10 S.W.G.	,,		3	1½
Tubes 1 in. o.d. 16 S.W.G.	,,		4	4
Aluminium Alloys				
BS 1470. HS19W.				
Sheet 10 S.W.G.	,,		3	3
Sheet 18 S.W.G.	,,		3	5½
Sheet 24 S.W.G.	,,		4	1
Strip 10 S.W.G.	,,		3	3
Strip 18 S.W.G.	,,		3	4½
Strip 24 S.W.G.	,,		4	0½
BS1477. HP30M.				
Plate as rolled	,,		3	1
BS1470. HC15WP.				
Sheet 10 S.W.G.	,,		4	3
Sheet 18 S.W.G.	,,		4	8½
Sheet 24 S.W.G.	,,		5	8½
Strip 10 S.W.G.	,,		4	4
Strip 18 S.W.G.	,,		4	8½
Strip 24 S.W.G.	,,		5	4½

		£	s.	d.
Aluminium Alloys—cont.				
BS1477. HPC15WP.				
Plate heat treated	lb.		3	10½
BS1475. HG19W.				
Wire 10 S.W.G.	,,		4	2
BS1471. HT19WP.				
Tubes 1 in. o.d. 16 S.W.G.	,,		5	5
BS1476. HE19WP.				
Sections	,,		3	4
Split tube				
19 S.W.G. (⅛″)	,,		4	2
20 S.W.G. (⅛″)	,,		3	11
21 S.W.G. (⅛″)	,,		4	1
22 S.W.G. (⅛″)	,,		4	11
Welded tube				
14 to 20 S.W.G. (sizes ½″ to 1½″)	,,	3/5½ to 5/5		
Brass				
Tubes	lb.		1	9½
Brazed Tubes	,,		3	1¾
Drawn Strip Sections	,,		3	1¾
Sheet	ton	195	10	0
Strip	,,	195	10	0
Extruded Bar	lb.		1	11¾
Condenser Plate (Yellow Metal)	ton	184	0	0
Condenser Plate (Naval Brass)	,,	198	0	0
Wire	lb.		2	8½

		£	s.	d.
Beryllium Copper				
Strip	lb.	1	4	11
Rod	,,	1	1	6
Wire	,,	1	4	9
Copper				
Tubes	lb.		2	3⅛
Sheet	ton	262	10	0
Strip	,,	262	10	0
H.C. Wire	,,	281	5	0
Cupro Nickel				
Tubes 70/30	lb.		3	8¾
Lead				
Pipes (London)	ton	98	5	0
Sheet (London)	,,	96	0	0
Tellurium Lead	,,	£6 extra		
Nickel Silver				
Sheet and Strip 10%	lb.		3	11¾
Wire 10%	,,		4	4¾
Phosphor Bronze				
Wire	,,		4	2
Titanium (1,000 lb. lots)				
Billet 4½″ to 18″ dia.	lb.	47/-		48/-
Rod ¼″ to 4″ dia.	,,	85/-		53/-
Wire ·036″·232″ dia.	,,	159/-		99/-
Strip ·001″ to ·048″	,,	350/-		68/-
Sheet 8′×2′. 20 gauge	,,	73/-		
Tube, representative average gauge	,,	198/-		
Extrusions	,,	90/-		
Zinc				
Sheet	ton	106	5	0
Strip	,,	nom.		

FOREIGN QUOTATIONS

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

Belgium	fr/kg	£/ton
Copper: electrolytic	31.75	232 1
Tin	135.15	987 16

Canada	c/lb	£/ton
Aluminium	24.00	194 8
Copper: electrolytic	30.00	243 0
Lead	10.50	81 0
Nickel	70.00	567 0
Zinc: Prime western	12.00	97 4
High grade 99.95	12.60	102 1
High grade 99.99	13.00	105 6

France	fr/kg	£/ton
Aluminium	2.43	179 11
Antimony 99·0	2.80	206 18
Cadmium	16.75	1,247 16
Copper: electrolytic	3.21	237 4
Lead	.90	66 10
Nickel	9.00	665 2
Tin	13.84	1,022 15
Zinc: Thermic	1.07	79 1
Zinc: electrolytic	1.15	85 0
Scrap		
Copper: electrolytic	2.85	210 12
Heavy copper	2.85	210 12
No. 1 copper wire	2.78	205 8
Brass rod ends	2.20	162 11
Zinc castings	.85	62 16
Lead	.83	61 6
Aluminium	1.80	133 0

Italy	lire/kg	£/ton
Aluminium	370	216 1
Antimony 99·0	470	274 9
Copper: wire bars 99·9	445	259 17
Lead	161	94 4
Nickel	1,300	805 14
Tin	1,840	1,074 11
Zinc: electrolytic	170	99 3
Scrap		
Aluminium soft sheet clippings (new)	290	169 7
Lead, soft, first quality	133	77 13
Lead, battery plates	75	43 16
Copper, first grade	370	216 1
Bronze, commercial gunmetal	420	245 7
Brass: heavy	270	157 13
Brass: light	255	148 18
Brass, bar turnings	265	154 15
Old zinc	95	55 9

Switzerland	fr/kg	£/ton
Aluminium	2.50	210 5
Copper: electrolytic	2.88	242 4
Lead	.80	67 5
Nickel	7.68	645 17
Tin	11.68	982 5
Zinc: High grade 99.99	.98	82 8

Japan	Yen per metric ton
Scrap	
Copper: electrolytic	268,000
Copper wire No. 1	236,000
Copper wire No. 2	225,000
Heavy copper	231,000
Light copper	210,000
Brass, new cuttings	175,000
Red brass scrap	215,000

West Germany *Scrap*	D-marks per 100 kilos	£/ton
Used copper wire	215	195 17
Heavy copper	212	193 2
Light copper	185	168 10
Heavy brass	145	132 1
Light brass	110	100 5
Soft lead	50	45 11
Zinc	48	43 14
Used aluminium unsorted	90	82 0

United States	c/lb	£/ton
Aluminium	24.00	1591
Antimony 99·0	32.50	259 0
Cadmium	160.00	1,275 4
Copper: electrolytic	31.00	247 10
Lead	10.50	83 13
Nickel	81.25	647 11
Tin	123.62	985 5
Zinc: electrolytic	12.50	99 12

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£	£				Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	30/–	+9d.	11	9	7 6 9	33/9	26/3	35/–	26/6
400,000	2/–	Anti-Attrition Metal	1/3		NIL	4	NIL	1/3½	0/9	1/6	0/9
43,133,663	Stk. (£1)	Associated Electrical Industries ...	34/–		15	15	8 16 6	54/10½	28/3	67/3	38/3
3,895,963	1	Birfield	63/9	+2/3	10	15‡	3 2 9	78/9	45/–	51/3	29/–
4,795,000	1	Birmid Industries	65/3	—3/6	20	20	6 2 6	103/–	64/6	74/9	56/–
8,445,516	Stk. (10/–)	Birmingham Small Arms	21/6	—9d.	11½	11½K	5 8 6	36/10½	19/3	30/6	18/3
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	13/–		5	5	7 13 9	14/6	12/3	17/4½	14/9
476,420	Stk. (£1)	Ditto Cum. B. Pref. 6%	16/6		8	6	7 5 6	17/6	15/4½	20/–	17/1½
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6% ...	17/–	+9d.	6	6	7 1 3	18/–	15/3	21/1½	17/7½
21,737,634	Stk. (£1)	British Insulated Callender's Cables	58/9	+6d.	13½	13½	4 12 0	62/3	49/–	61/4½	47/–
30,683,348	5/–	British Oxygen Co. Ltd., Ord. ...	15/–	—6d.	16D	16	3 11 3	28/4½	14/9	35/–	19/10½
1,200 000	Stk (5/–)	Canning (W.) & Co.	16/6	+2/–	15½	25+*2½C‡	5 1 0	20/9	13/7½	19/9	13/7½
60,484	1/–	Carr (Chas.)	1/1½	+3d.	NIL	—	—	1/7½	10½d.	2/3	1/–
550 000	1	Clifford (Chas.) Ltd.	27/9		12	10	8 13 0	31/–	26/–	35/–	28/9
45,000	1	Ditto Cum. Pref. 6%	15/–		6	6	8 0 0	15/3	15/–	16/–	15/10½
1,166,000	Stk. (2/–)	Clifford Components V	8/6		25*2½C	25*2½C	5 17 9	10/1½	7/3	11/9	6/10½
300,000	2/–	Coley Metals	2/9		15	15	10 18 3	4/5½	2/7½	5/–	3/4½
10,185,696	1	Cons. Zinc Corp.†	50/–	—1/–	20 O	15	8 0 0P	81/6	49/3	80/9	59/6
5,399,056	5/–	Davy-Ashmore	31/–	+1/–	27½	22½	4 9 3	44/6	29/–	147/3	99/6
8,995,011	5/–	Delta Metal	21/3	+9d.	20	17½	4 14 0	27/7½	19/–	28/3	18/6
5,296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	37/6	+1/3	15	15	8 0 0	52/3	36/–	56/9	45/–
1,155,000	1	Evered & Co.	42/–		10	10¢B	4 15 3	45/9	42/–	42/9	29/3
18,000,000	Stk. (£1)	General Electric Co.	28/3	—9d.	10	10	7 1 6	39/6	24/3	47/9	29/–
1,500,000	Stk. (10/–)	General Refractories Ltd.	48/3	—6d.	25	20	5 3 6	65/–	42/9	52/6	40/–
937,500	5/–	Glacier Metal Co. Ltd.	19/–	+1/–	15	13	3 18 9	21/1½	13/9	16/1½	11/1½
2,750,000	5/–	Glynwed Tubes	23/9	+1/–	22½	25¶	4 14 9	30/3	22/6	27/6	17/–
7,228,065	10/–	Goodlass Wall & Lead Industries ...	31/9	+1/–	15	19L	4 14 6	44/9	28/–	41/9	33/–
696,780	10/–	Greenwood & Batley	14/6		15	30‡	10 7 0	29/6	14/3	33/6	29/1½
792 000	5/–	Harrison (B'ham) Ord.	8/9		*10	*20‡	5 4 3	14/6	8/6	15/10½	11/9
150,000	1	Ditto Cum. Pref. 7%	18/3		7	7	7 13 6	20/4½	18/–	23/6	22/–
1,612,750	5/–	Heenan Group	13/9	+9d.	13	11½K	4 14 6	17/1½	10/6	13/–	9/10½
266,608,683	Stk. (£1)	Imperial Chemical Industries ...	61/9	—1/9	13½	11½	4 9 3	81/6	56/3	76/6	54/–
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	14/7½	—4½d.	5	5	6 16 9	16/–	13/10½	18/–	15/4½
29,196,118	**	International Nickel	139	—4	$1.60	$1.50	1 18 0	160	104	105	84½
6,000,000	1	Johnson, Matthey & Co.	77/6	+2/6	15	12	3 17 6	80/–	57/6	67/6	44/9
600,000	10/–	Keith, Blackman	17/–		17½	17½E	10 6 0	21/6	16/6	32/6	17/6
320,000	4/–	London Aluminium	10/3	+3d.	N	13	—	15/–	8/6	12/6	7/10½
2,667,542	1	McKechnie Bros. A Ord.	32/–	+9d.	11½K	17½	7 8 0	53/3	31/3	69/3	55/–
1,108,268	5/–	Manganese Bronze & Brass	9/6	+6d.	20½	20½	10 10 0	18/6	8/3	18/6	13/4½
50,628	6/–	Ditto (7½% N.C. Pref.)	5/–		7½	7½	9 0 0	6/–	5/–	6/6	5/9
26,361,444	Stk. (£1)	Metal Box	86/–	+1/–	12	12M	2 15 9	100/9	68/3	84/3	61/–
415,760	Stk. (2/–)	Metal Traders	5/6	—1/9	25	50H	9 1 9	8/9	5/6	10/9	7/1½
240,000	1	Mint (The) Birmingham	35/6	+6d.	15G	12½	5 12 9	35/9	24/–	39/–	33/6
80,000	5	Ditto Pref. 8%	71/–		6	6	8 9 0	77/6	70/–	80/–	75/–
274,152	1/–	Minworth Metals	4/9		30	30S	6 6 3	6/3	4/6½	5/2½	3/10½
5,187,938	Stk. (£1)	Morgan Crucible A	59/9	+1/–	14	13	4 13 9	71/3	53/4½	63/–	47/6
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	15/6		5½	5½	7 2 0	17/–	13/10½	18/9	15/9
3,850,000	Stk. (£1)	Murex	40/6	+1/–	13	22½J	6 8 6	52/–	36/9	45/–	35/3
585,000	5/–	Ratcliffs (Great Bridge) Ord ...	15/6xd		10	10R	3 4 6	16/6	15/6	17/–	14/9
1,064,880	10/–	Sanderson Kayser	35/–	—6d.	17½	35‡	5 2 9	41/3	29/–	40/3	27/7½
3,400,500	Stk. (5/–)	Serck	13/–		12½	12½	4 16 3	19/3	12/10½	25/6	15/3
212,384	5/–	Stedall & Co.	7/6		15	15	10 0 0	10/3	7/3	10/3	6/3
8,035,372	Stk. (£1)	Stone-Platt Industries	38/–	—2/–	16O	15	8 8 6W	67/–	38/–	64/4½	52/3
2,928 963	Stk. (£1)	Ditto 5½% Cum. Pref.	15/–		5½	5½	7 6 9	18/–	13/6	18/7½	15/3
35,344,881	Stk. (£1)	Tube Investments Ord.	65/–	—2/–	14	18½	4 6 3	85/6	54/–	140/3	63/10½
41,000,000	Stk. (£1)	Vickers	27/–	+1/–	10	10	7 8 3	38/3	25/9	39/7½	27/1½
750,000	Stk. (£1)	Ditto Pref. 5%	13/6		5	5	7 8 3	15/–	12/4½	17/6	13/3
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	19/9	—3d.	*5	*5	7 10 9A	21/1½	18/–	24/6	20/1½
4,594,418	1	Ward (Thos. W.) Ord	65/6		13½	13½	4 4 0	84/6	64/6	94/–	63/–
7,109,424	Stk. (£1)	Westinghouse Brake	26/–		11	10	8 9 0	46/3	24/6	60/6	37/6
323,773	2/–	Wolverhampton Die-Casting ...	7/6	–3d.	35	30	9 6 9	13/4½	7/–	13/10½	8/1½
591,000	5/–	Wolverhampton Metal	21/9	–1/3	32½	32½	7 9 6	30/–	19/6	39/9	23/9
156,930	2/6	Wright, Bindley & Gell	4/4½	+1½d.	15	20‡	8 11 6	4/9	3/7½	4/6	2/10½
124,140	1	Ditto Cum. Pref. 6%	12/9		6	6	9 8 3	13/7½	12/6½	15/–	13/6
150.000	1/–	Zinc Alloy Rust Proof	4/6	–3d.	40	30	8 17 9	5/6	4/–	5/4½	4/–

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡and 100% capitalized issue. ¤ The figures given relate to the issue quoted in the third column. A Calculated on £7 8 9 gross. D and 50% capitalized issue. C paid out of Capital Profits. E and 50% capitalized issue in 7% 2nd Pref. Shares. R and 33⅓% capitalized issue in 8% Maximum Ordinary 5/– Stock Units. ¢ and 6¼% from Capital Profits. B and 50% capitalized issue. G and 50% capitalized issue. F and special 5% tax free dividend and 50% capitalized issue. ¶and 3 for 7 capitalized issue. L and 33⅓% capitalized issue. M and 10% capitalized issue. J and 75% capitalized issue. Q also 1/– special tax free dividend and 50% capitalized issue. T Per £1 unit. K 50% capitalized Issue allowed for. S and 50% capitalized issue. V incorporating Clifford Covering. H including bonus 12½%. N current interim dividend passed. O current interim reduced. P calc. at 20%. W calc. at 16%.

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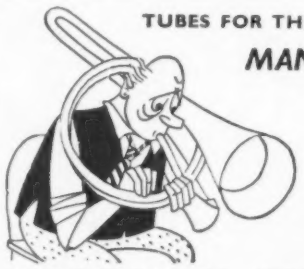

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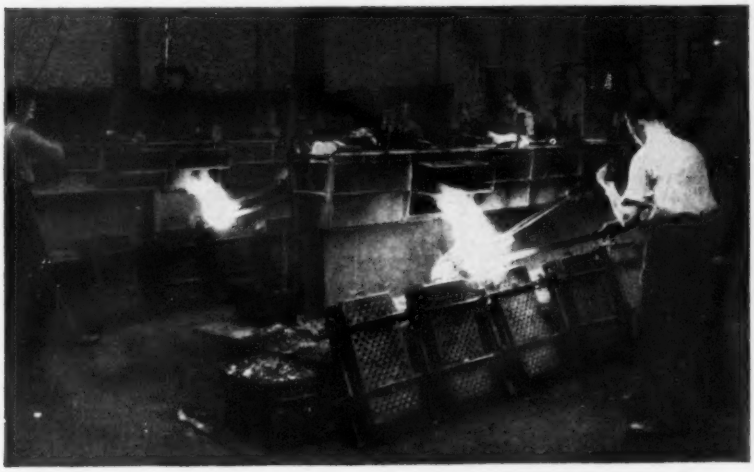

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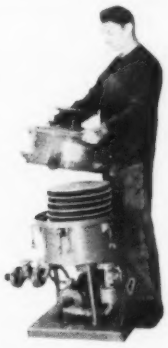

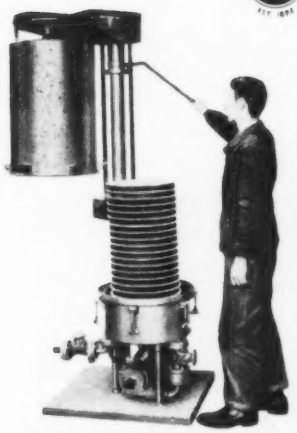

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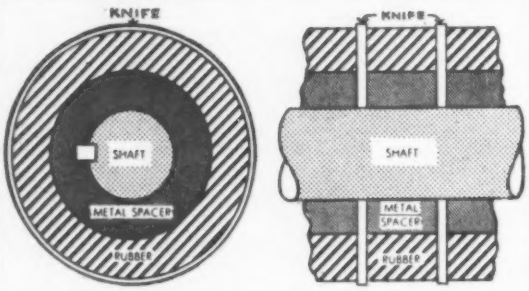

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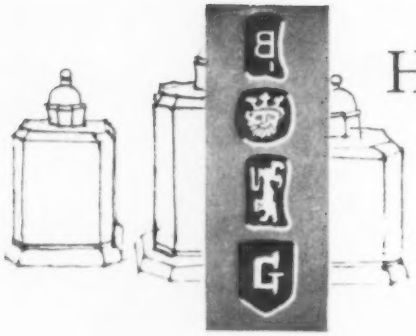

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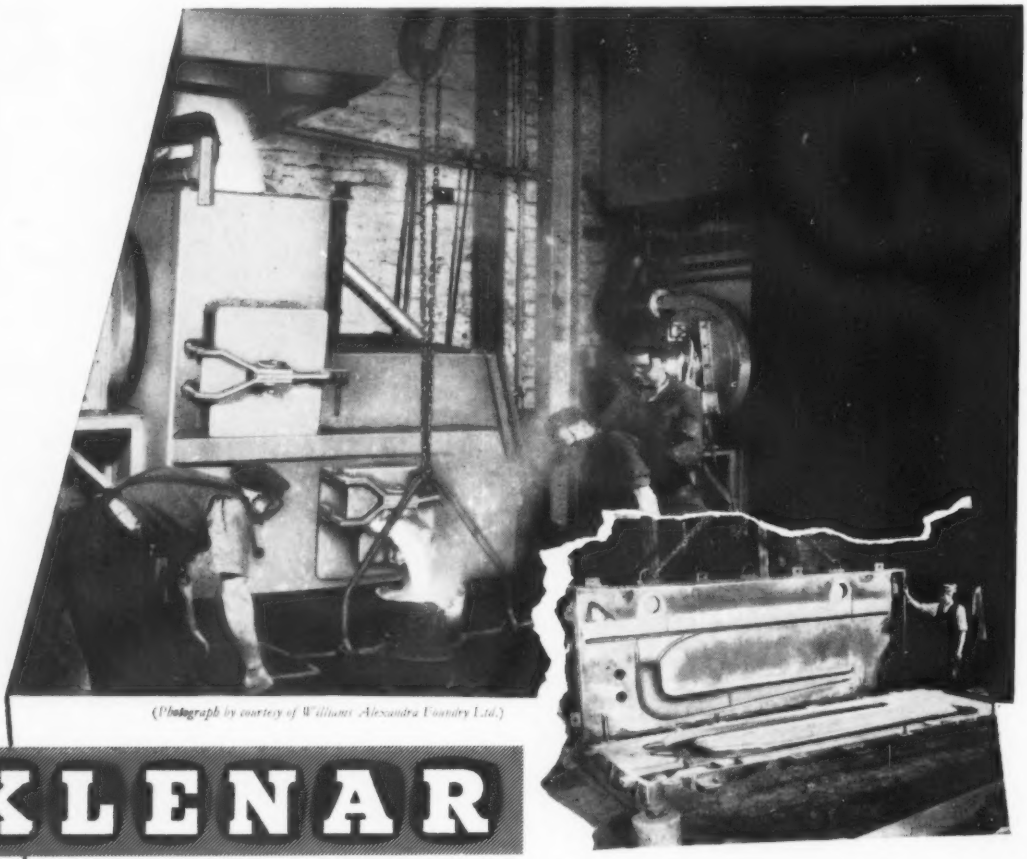

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